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SCHOOLING AND DISTRIBUTION OF EARNINGS IN A RAPIDLY DEVELOPING LDC: THE CASE STUDY OF HONG KONG

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ABSTRACT

This study attempts to examine the schooling effect on the distribution of earnings in Hong Kong within a human capital framework.

Two hypotheses are formulated in this study. Hypothesis One postulates a significant effect of schooling on the earnings distribution in the aggregate set. Hypothesis Two postulates a significant effect of schooling on the earnings distribution in the overtaking set. The earnings inequality function is applied to the aggregate set to verify Hypothesis One. The variance form of the schooling model is applied to the overtaking set to verify Hypothesis Two. The source of data is the 1986 By-Census of Hong Kong which covers 1/7 of the total population with about 750,000 records. The aggregate set in the present study covers only male employees and male self-employed professional workers, aged 15 to 60, in either the government or the private sector. The overtaking set is defined as the group of the workers aged 15 to 60 with 8 to 10 years of work experience.

The results of the present study show that the schooling component has a significant contribution toward the earnings inequality in both the aggregate set (26 per cent) and the overtaking set (42 per cent) in Hong Kong. Thus, both Hypothesis One and Hypothesis Two are substantiated. The results also show that schooling is positively and significantly related to individual earnings in Hong Kong. Furthermore, the results

indicate that there are smaller inequalities in both earnings and schooling in the younger cohorts who are under the influence of the education expansion. All these suggest that schooling may have a significant effect on the distribution of earnings in Hong Kong. Therefore, within a human capital context, two policy options may emerge for a reduction in the inequality of earnings in Hong Kong.

One is the universalization of schooling. The results of the present study indicate that the universal lower secondary education implemented by the government over the past decades might have an effect on reducing earnings inequality in Hong Kong. Therefore, the researcher would recommend that the government should continue to provide universal lower secondary education and extend the universalization of schooling to the Form Five level.

Another policy option is the provision of a second opportunity of schooling. This policy option may alleviate the inequality of schooling and probably the inequality of earnings within the older groups. It may also alleviate the inequality of schooling and, thus, may reduce the earnings inequality between the younger and older cohorts. Furthermore, it may decrease the differences between the rates of return to upper and lower levels of schooling and, thus, may reduce the earnings inequality.

However, a careful manpower planning is needed to ensure

that the two policy options meet the demand of the labour market. In addition, it should be noted that the role of schooling in determining the earnings distribution in Hong Kong may change subject to the influence of the government.

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STATEMENT OF THE PROBLEM

Concern with Income Size Distribution

Income distribution is one of the oldest subjects of economic enquiry. Adam Smith and David Ricardo, the founders of classical economics, were both concerned with the distribution of income. The "Supreme importance" of the distribution of income has been reasserted many a time during the past decades. (Bronfenbrenner 1971:Chapter 1)

Economists have great interest in income distribution most probably because they want to find out what policies might change the distribution of income - presumably in the direction of greater equality. (Rivlin 1975:11) The unequal distribution of income between the rich and the poor can breed social conflicts, civil and political disturbances. The narrowing of income gap between the rich and the poor has long been a major concern with economists. To economists such as Montek S. Ahluwalia and Hollis Chenery, a concern with income distribution is not simply a concern with income shares but rather with the level and growth of income in lower-income groups. (Ahluwalia et al. 1974:38)

Demographic-social changes dramatically disequalize income distribution[1]. The dramatic disequalization thus increases

[1] Typical examples are the rising average age of family heads and the changing status of women. For details, see Rivlin (1975 pp.1-2).

public awareness and political concern with inequality in the distribution of income. Instant communication and the apparent rise in group identities have made people more conscious of what others have and do not have. People become more conscious of pressing their advantages in income shares through the law, collective bargaining, public relations, political influence, and even civil disobedience. (Rivlin 1975:1)

The problem of income distribution was primarily studied by the classical writers in the manner among factors of production. (Atkinson 1975:2-3) Nowadays the identification of social classes with the ownership of particular factor of production does not necessarily hold. (Atkinson 1975:2) Knowledge of the factor shares of the income distribution does not help us understand the income inequalities among individuals. The implications of a rise in income may be quite different if it accrues to widows and orphans rather than to millionaires. (Atkinson 1975:2-3)

It is therefore important to go beyond the question of factor shares with which classical writers were concerned and to consider the distribution among persons, i.e., the personal income distribution or the income size distribution. (Atkinson 1975:2-3) Irving Fisher even observes that "no other problem has so great a human interest as this [the distribution of personal income]". (Fisher 1912) It is observed that in recent decades, neoclassical economists have initiated a subtle shift of concern from the distribution of income between capital and labour (the

functional approach) to the distribution of income among wage earners alone (the personal approach to labour income)[1].

For most people, earnings are the most important, if not the only, source of income in modern economy. (Atkinson 1975:17) A view of the distribution of earned incomes (labour income) is essential to an understanding of the nature of inequality in any advanced economy. (Atkinson 1975:17) Furthermore, there is evidence that developments over longer periods clearly show an outspoken shift of income from capital to labour. It appears that the labour share of income increased by about 15% between 1929 to 1960 in the United States. The labour share of income also increased obviously in a number of Western countries. (Atkinson 1975:167; Carnoy 1979:6) It also appears that the capital share of income decreased by 19% over the century between 1850-60 and 1950-60 for Britain and France respectively. Over the half century in the United States, the same rate of reduction per annum applies. (Tinbergen 1975:5) To Kuznets, this shift of income from capital to labour is not an occasional event. He predicts that as capital accumulates, population growth slows down, the general level of skill and training improves, and labour rather than capital becomes scarce, then the labour share of income will gradually increase. (Kuznets 1955; Carnoy 1979:6) As the share of labour income in income distribution becomes more

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[1] See Carnoy (1979 pp. 7) and Atkinson (1975 pp.3 footnote 1) This shift can be illustrated by two works (Atkinson 1975; Atkinson (ed.) 1976). In the former only one chapter out of thirteen is devoted to factor shares, and in the latter no chapter is devoted to factor shares and five chapters out of nine are focused on earnings among persons. The shift is also illustrated by the work on a survey of theories of personal income distribution written by Sahota (1978). In this survey, theories are addressed primarily to earned incomes except for the inheritance theory. The inheritance theory is addressed primarily to unearned incomes.

and more important, it is conceivable that the concern with the factor shares shifts to the concern with the shares only among wage earners.

In conclusion, the distribution of the size of income received by each earner deserves more theoretical and empirical exploration.

Income Size Distribution and Schooling

Concern with income size distribution has been shared by economists and educators alike because schooling is often regarded as one of the forces shaping the income size distribution. Many economists not only argue that a provision of schooling will contribute to economic growth and development, but they see it as a powerful, long-term and viable method of equalizing income size distribution[1]. First of all, they hold the view that the greater the equality of schooling in a region the more equal the distribution of income[2]. Furthermore, schooling is generally regarded as a policy variable which can be controlled and changed by public policy to promote equality in income size distribution without sacrificing economic efficiency and economic growth[3]. Finally, schooling as a policy variable of equalizing income inequality is considered

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1 See Ahluwalia et al. (1974 Chapter III, IV and XI); Psacharopoulos and Woodhall (1985 pp. 266).

2 See Solow (1960 pp. 450-453); Fields (1980 pp. 282-283); Ram (1989 pp. 189-190).

3 See Schultz (1971 pp. 46-47, pp. 174-175); Adelman and Morris (1973 pp. 101); Ahluwalia et al. (1974 pp. 47, pp. 90); Psacharopoulos and Woodhall (1985 pp. 267).

politically viable. Political constraints upon implementing education policies are on the whole less restrictive[1]. Any radical redistribution method may provoke protest, but the provision of schooling never.

Behind these views about the remarkable features of schooling in equalizing the income size distribution, however, there is an assumption that schooling does affect income size distribution and the effect on income size distribution is significant. If schooling has no effect on income size distribution or the contribution of schooling toward the earnings inequality is not significant, there is no ground for us to see it as an equalizer of income size distribution. Hence, knowledge of the effect of schooling on income size distribution is essential for the analysis of the role of schooling in income size distribution.

However, according to Ram, studies which provide empirical evidence about the schooling effect on income size distribution are not plentiful due to data difficulties in spite of the fact that arguments about the role of schooling in income size distribution are numerous. (Ram 1989:188) More essential, the empirical findings about the effect of schooling on income size distribution are inconsistent : some studies report a significant effect of schooling on income size distribution but others do not. (Fields 1980: 282-284; Psacharopoulos and Woodhall 1985:264-270) Fields, for example, summarized the empirical

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[1] See Adelman and Morris (1973 pp. 101); Ahluwalia et al. (1974 pp. 81); Blaug (1978 pp. 5).

evidence about the schooling effect on income size distribution from developed and developing countries in a review of literature. There was evidence that countries with higher levels of schooling exhibited less income inequality and greater inequality of education attainments was associated with greater income inequality. However, there were also findings reported in the same review that suggested an insignificant and even adverse effect of schooling on income size distribution. (Fields 1980: 282-284) Ram also pointed out that the empirical evidence about the schooling effect on income size distribution appeared generally inconclusive after a selective review of a dozen empirical studies on the subject. (Ram 1989: 185-195)

Hence, the schooling effect on income size distribution deserves more empirical exploration.

The Case of Hong Kong

Some economists postulate that schooling effect on income size distribution will be much greater in developing countries, particularly those developing countries with a marked shortage of educated or skilled labour. (Ahluwalia et al. 1974:82) A developing country often has a combination of non-marginal education changes and lower substitution possibilities between different types of educated labour. An increase in the average level of schooling in such a country is likely to have a greater effect on reducing the income inequality. (Marin and Psacharopoulos 1976:337) Furthermore, a developing country with

a marked shortage of educated labour provides more and better opportunities of employment for the educated labour. More and better opportunities of employment for the educated labour therefore allow higher schooling effect to be reflected in the income size distribution[1]. Besides, education opportunities are likely to be more unequally distributed in developing countries.

Thus, Hong Kong is a place which is suitable for the assessment of the schooling effect on income size distribution.

First of all, Hong Kong is a developing country[2].

Its prosperity and rapid development as well as the expansion of the service sector create a marked shortage of educated labour. The shortage of educated labour is also a result of the élite approach to the provision of senior secondary schooling adopted by the Hong Kong government until the early 1980s. (Government Secretariat 1981:137-170)

Before the late 1960s, the schooling opportunities were limited and unequally distributed in Hong Kong since the government granted low subsidies to education and many people could not afford to receive their education in private institutions. In 1961, for example, only 14% of the whole population received secondary education. (Luk and Wu 1983) This

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1 Henry Levin pointed out that little schooling effect would be reflected in the incomes of those who could not participate in the labour force. See Levin (1977 pp. 125).

2 Hong Kong is considered a developing country, for example, in The Third World Economic Handbook (Sinclair 1982), The Developing World: An Introduction (Simpson 1987), and Growth And Development With Special Reference To Developing Economics (Thirlwall 1989).

situation, to a certain extent, was improved since the government started to provide more subsidized education for the children and the youth in the late 1960s. In 1981, for example, people who received secondary education rose to 33% of the whole population. (Luk and Wu 1983)

The education changes in Hong Kong are obviously dramatic. Before the late 1960s, many people in Hong Kong were illiterate. However, the government successfully started to implement universal primary education in the late 1960s and universal junior secondary education in the late 1970s! (Government Secretariat 1981:137-170)

In short, if we attempt to assess the schooling effect on income size distribution, Hong Kong is a suitable place for the assessment.

The Problem of the Study

As mentioned above, knowledge about the effect of schooling on income size distribution is crucial for the analysis of the role of schooling in income size distribution.

This study therefore attempts to provide empirical evidence about the effect of schooling on the distribution of earnings in Hong Kong, a rapidly developing LDC. (LDC refers to the less

developed country.)[1] There are two special concerns of this study. One is the effect of schooling on the aggregate distribution of earnings. Another one is the effect of schooling on the distribution of earnings which is least contaminated by the effects of work experience.

[1] The term "developing countries" came into current usage in the 1960s and began to replace the less complimentary expression "underdeveloped" or "backward". See Pearce (ed.) (1986 pp.105)

CHAPTER II

REVIEW OF LITERATURE

There is an opinion that far too little is known about the distribution of personal income. However, it does not mean that no distribution theories exist. (Sahota 1978:1) As a matter of fact, theories have been developed to put forth various determinants of income size distribution[1]. Among these determinants, schooling is a determinant that concerns both economists and educators. The present study would focus on the effect of schooling on income size distribution only.

Schooling As a Determinant of Income Size Distribution: The Theories

Schooling has been generally accepted as a determinant of income size distribution[2]. Fields even wrote that education was the single most important determinant of income. (Fields 1980:238) Equalizing education investments is at the heart of many of the economic and social policies that have been adopted over the past decades. However much they may differ on other matters, people at all points of the political spectrum all affirm the central importance of education (human investment) as a means of altering the distribution of earnings, especially the income share of the poverty. (Thurow 1975:188-189)

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[1] Without claiming to be exhaustive, these determinants of income size distribution are listed in Appendix I.

[2] See Psacharopoulos and Woodhall (1985 pp. 266); Fields (1980 pp. 238-282); Taubman (1978 pp. 86); Tinbergen (1975 pp. 60); Okun (1975 pp. 95); Thurow (1975 pp. 193); Ahluwalia et al. (1974 pp. 29); Adelman and Morris (1973 pp. 101) etc.

Obviously, schooling is a policy variable which can be changed and controlled by the public policy. (Ahluwalia et al. 1974:18 and 29)

Furthermore, equalizing income size distribution by reducing inequality of schooling is considered politically viable. As Bowles pointed out, "the popularity of education reform among liberals and progressives stemmed from more political considerations: education equalization seemed to offer a strategy for achieving the greater social equality that was politically viable. More equal education, it was confidently asserted, could achieve significantly greater equality of economic opportunity and incomes without challenging the basic economic institutions of society and without requiring any major redistribution of capital." (Bowles 1972:S219) Schooling is widely accepted as a sector for significant public sector involvement and the political constraints upon implementing education policies are on the whole less restrictive[1]. People at all points of the political spectrum agree that, if they were running the country, education policy would be the cornerstone of their efforts to improve the condition of the poor and of minorities on the assumption that if the poor or the minorities were better educated, they could get better jobs and higher income and, thus, more shares of the income distribution. (Thurow 1975:188-189) Furthermore, education may function its redistribution role without violating the major tenets of our social, economic and political systems.

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[1] See Ahluwalia et al. (1974 pp. 81); Adelman and Morris (1973 pp. 101); Blaug (1978 p. 5).

Besides these considerations, education investments in the poor may also lead to long term pay-offs to the rich who need productive workers to operate their capital[1]. Obviously, investment in education is the intervention in which the poor would gain whereby rich - and politically powerful - losers could be actually compensated, while leaving the poor better off than before. (It should be noted that the rich and privileged groups who always have influence on economic and social systems, unlike the poor and disadvantaged groups, are often organized or in alliance to influence the political system[2].) Furthermore, investment in education is a kind of evolutionary rather than a kind of revolutionary intervention which alters the distribution of the increment to the overall capital stock and income[3]. Such intervention will arouse less hostility from the rich than transfers which bite into their existing assets and incomes[4] because the costs to the losers are less "visible"[5].

In addition, expanding education is always considered an intervention which promotes both efficiency, growth and income equality.

Unlike other types of intervention such as consumption transfers which redistribute the current income, expanding education is a kind of intervention which redistributes the future income by seeking for equality of opportunity (Rivlin

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1 See Ahluwalia et al. (1974 pp. 54-62).

2 See Ahluwalia et al. (1974 pp. 52-53); Rivlin (1975 pp. 12).

3-5 See Ahluwalia et al. (1974 pp. 54-62).

1975:6; Ahluwalia et al. 1974:56-62). Under such intervention each individual is still rewarded according to merit. (Thurow 1975:189) Hence, incentives for work efforts and productive contribution will not be impaired and therefore there is efficiency. Such intervention can avoid the inefficiencies generated by the direct transfer system such as welfare cheating[1]. Introducing universal elementary schooling or equalizing financing opportunities for higher education, for example, is considered one of the ways by which the nation can obtain more efficiency and more equality - without sacrificing one for the other[2].

Education expansion with the goal of redistributing income is defensible because at least it gives naturally productive people a chance rather than a handicap, which may actually increase total output. (Rivlin 1975:6-7) Redistribution of current income may result in misallocations and less supply of labour and, thus, may reduce the aggregate income. As a means of equalizing opportunity which redistributes future income, education may not have these deficiencies. (Rivlin 1975:6-7) It is widely accepted that education expansion may play a significant role in raising the overall level of income, i.e., economic growth, while promotes distributional objectives without raising problems of trade-offs[3].

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1 Welfare cheating allows "welfare cheaters" who are capable of work but instead choose to stay at home and be supported by the over taxed, hard working middle class. (Taubman 1978:100-101)

2 See Schultz (1971 pp. 175); Ahluwalia et al. (1974 pp. 227-232).

3 See Schultz (1971 pp. 46-47, pp. 174-175); Ahluwalia et al. (1974 pp. 47, pp. 90); Psacharopoulos & Woodhall (1985 pp. 267); Adelman & Morris (1973 pp. 101). Arthur M. Okun called the conflict between equality and efficiency as "the Big-Tradeoff" (Okun 1975 pp. 1)

The rise of the overall level of income due to education investment lowers the absolute level of poverty[1]. To lower the absolute level of poverty is also an essential objective of income redistribution. Schooling may also alleviate the perpetuated intergeneration income inequality as it may raise the relative position in the income distribution of people whose parents are near the low end. (Rivlin 1975:9) In addition, in the long run expanding education may improve health of the poor and may lower fertility and population growth. These effects on health, fertility and population growth are likely to increase the earning power of the poor and, thus, narrow the income disparities among the poor and other groups[2].

In short, schooling is regarded as a determinant of income size distribution which gives policy directions. Equalizing education investments to reduce inequality of personal income is considered politically viable. It may promote equality in income size distribution, as some writers observe, without sacrificing economic efficiency and economic growth. Behind these views about the outstanding features of schooling in equalizing the income size distribution, however, there is an assumption that schooling does affect income size distribution and the effect is significant. According to Cohn, four theories of income size distribution have argued for or against this assumption. They are human capital, credentialism, dual labour market and Marxist views. (Cohn 1979:28-32)

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1 See Psacharopoulos and Woodhall (1985 pp. 267); Ahluwalia et al. (1974 pp. 227-232).

2 See Psacharopoulos and Woodhall (1985 pp. 267, pp. 290-304); Adelman and Morris (1973 pp. 35).

Human capital theory argues for the assumption. The basic premise of the human capital approach is that variations in labour income are due, in part, to differences in labour productivity and the differences in labour productivity are due to the differences of the amount of human capital acquired by the workers. (Cohn 1979:28-29) According to the theory, one of the major sources of human capital is schooling. In other words, human capital theory relates schooling to income size distribution. Therefore, if one wishes to reduce income inequality, one way to achieve this would be to reduce inequality in the investments in schooling[1].

Credentialism or screening theory also suggests that schooling has important effects on the distribution of personal income. However, screening theory argues that investments in education generate credentials instead of productivity to determine the individuals' labour income. In the opinion of the credentialists, schooling is only a screening device which gives credentials to the workers and signals to the employers. Different credentials represent different kinds of attributes sought by the employers and therefore different wages are paid for these credentials. Productivity-enhancing effects of schooling proposed by the human capital approach are thus disregarded. However, education as a screening device is still considered to have important effects on distribution of income because education screening provides the primary determinant of one's initial job opportunities and hence of what screening can

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[1] See Cohn (1979 pp. 28-32); Velloso (1975 pp. 13) and Sahota (1978 pp. 21).

occur subsequently. In other words, screening theory also relates schooling to income size distribution, though it gives different reasons[1].

Another challenge to the human capital approach comes from the proponents of the labour market segmentation theory or the dual labour market theory. The labour market segmentation theory argues that there are actually segments of the labour market. Certain segments provide better training slots and job ladders with promise of economic and job mobility for the workers. On the other hand, training slots and job ladders in other segments are inaccessible to the workers no matter what stock of schooling and training of the workers happens to be. The dual labour market theory argues that the human capital approach is correct only for the former segments but not the latter. In other words, the dualists relate schooling to the income size distribution of certain segments of the labour market only[2].

Some reviewers regard the Marxist approach to labour income distribution as a radical version of the labour market segmentation theory[3]. The Marxist approach provides a totally different explanation of the role of schooling in the distribution of labour income. (Cohn 1979:31) Notable among the

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1 See Cohn (1979 pp. 28-32); Arrow (1973); Spence (1973); Stiglitz (1975).

2 See Cain (1976); Doeringer and Piore (1971); Mayhew and Rosewell (1979); Leigh (1976) and Cohn (1979 pp. 28-32).

3 Marxian or so-called "radical" theories are similar to dual labour market theories in drawing upon sociological analysis of institutional change, but the Marxians give move emphasis to historically-rooted, social class based behavioral motivations of employers and workers than the dualists. (Cain 1976 pp. 1223)

proponents of the neo-Marxist approach are Bowles and Gintis[1].

Bowles and Gintis formulate their argument by introducing Marx's distinction between "labour" and "labour power". (Bowles and Gintis 1975:76-81) "Labour power is the capacity of the individual to contribute to the production process in its current technical and organizational form." (Bowles and Gintis 1975:76) According to their views, the working classes surrender disposition over their "labour power" to the capitalists in the labour market in return for wages. The "labour" or actual work supplied by the individual, by contrast, is not determined by exchange relations at all. It depends in an essential way on the social and political structure of the enterprise. The capitalists maximize their profits by holding down the wages as much as possible and exploiting the labour power of each worker to the fullest, that is, by getting as much labour as possible out of each worker. Therefore, "the production of 'better workers' cannot be understood simply by reference to how-individual worker-skills are related to individual worker-productivities." (Bowles and Gintis 1975:77) To the capitalists, a highly skilled work force is not necessarily a profitable work force. Because of the essential role of education in reproducing the capitalist order, schooling therefore promotes willingness of the workers to comply to the capitalist workplace, regulations and imperatives. Hence, "schooling may increase the ease with which the employer can extract labour from a worker with given labour power by generating or selecting individual motivational

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[1] See Cain (1976) and Cohn (1979 pp. 31-32)

patterns more compatible with the class-based power structure and incentive mechanisms of the enterprise." (Bowles and Gintis 1975:80) Thus, the education system does much more than producing human capital. It segments the labour force, forestalls the development of working class consciousness, and legitimates economic inequality by providing an open, objective, and ostensibly meritocratic mechanism for assigning individuals to unequal occupational positions. (Bowles and Gintis 1975:78)

Obviously, these theories have different emphases when they are applied to explain the income size distribution. Human capital theory, for instance, puts more emphasis on the supply side on the labour market. (Tinbergen 1975:10) On the other hand, the labour market segmentation theory puts more emphasis on the demand side on the labour market. (Sahota 1978:17) As Tinbergen observes, however, there is a need to consider both demand side and supply side on the labour market. (Tinbergen 1975:8-16)

Thus, schooling as a determinant of income size distribution cannot be viewed independently of labour market conditions. It is therefore conceivable for Ahluwalia to observe that "the relevance of the human capital approach to education is much greater in underdeveloped countries where there is a marked shortage of labour skills. In these countries, an adequate supply of skilled labour is a necessary condition for any sustained expansion in output and would be part of any growth-oriented strategy." (Ahluwalia et al. 1974:82)

In addition, as Carnoy observes, schooling cannot be viewed independently of the government incomes policy when it plays its role in influencing earnings distribution. Educational policy can only contribute to the more equal distribution of earnings when it is carried out in concert with an income policy which attempts to equalize earnings inequality. (Carnoy 1979:98)

Debate on the theories of personal income distribution has been kindled in the recent decades. Though the divergence of these theories remains wide, as Sahota observes, "scarcely any theory denies the validity of other theories on the basis of logic or rationality." (Sahota 1978:40) According to Sahota, a basic contribution to the debate on the theories of personal income distribution has come from the human capital approach to distribution of labour income. (Sahota 1978:38) The human capital school, as Tinbergen observes, concentrates on the education process as a supply factor on the labour market. (Tinbergen 1975:10) Its rival theories, however, draw our attention from the supply side on the labour market to other aspects of the income size distribution.

The theorectical framework used in this study will be based on the human capital approach to distribution of labour income. However, ideas from other points of view may be also taken into account in this study.

Schooling As a Determinant of Income Size Distribution: The Evidence

Numerous corroborations provide substantial ground for the belief that schooling has a significant effect on income size distribution.

A set of studies investigated the dispersion of education and its relation to income inequality. One of the studies was done by Solow (1960). Solow suggested that the long run trend toward a decreased dispersion of schooling in the U.S. brought about a decreased inequality of income. (Solow 1960:450-53) One of the studies was done by Chiswick (1971). Because of data limitations at the time, Chiswick was restricted to a cross-section study of just nine countries, four of them developing. He found a statistically significant relation between income inequality and the variable measuring inequality of education attainments with the anticipated positive sign in two out of three cases. Further evidence was presented by Psacharopoulos (1978). His study - which for forty-nine countries (eleven of them developed) - showed that education inequality was positively and significantly associated with the Gini coefficient of income inequality. (Fields 1980:282-283; Ram 1989:189-190)

One set of studies examined education level (as measured by school enrollment ratios, literacy rates, or average education attainment) and its relation to income inequality. Using a sample of forty-three developing countries, Adelman and Morris

(1973) concluded that the "rate of improvement of human resources" (as measured by the school enrollment rate) was significantly and negatively related to income inequality.[1] A similar negative relation between school enrollment and income inequality was found in subsequent research by Chenery and Syrquin (1975), who used a somewhat larger sample of developing countries.[2] Consistent with these results were the findings of Ahluwalia (1974, 1976).[3] Based on a sample of sixty-two developing countries, Ahluwalia found that higher levels of literacy were associated with lower relative income inequality in the cross section. Further evidence was provided by Morrisson (1987).[4] Morrisson's study, which was based on a cross-section study of 37 LDCs, revealed that schooling level had a strong equalizing effect and the effect might be more important than that of any other variable in the model. This study, as its counterparts of the set, did not include any variable to represent schooling inequality.[5]

One set of studies included both the level and dispersion of schooling as the explanatory variables. Using 1970 Brazilian census data restricted to non-enrolled males in the urban labour force, Velloso found that his results substantiated the human capital hypotheses, i.e., both the level and dispersion of schooling would be positively and significantly related to the inequality in earnings. He also made comparisons between the contributions of the schooling component toward earnings inequality in Brazil and the U.S. The results of the comparisons

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1-5 Fields (1980 pp. 282-283); Ram (1989 pp. 189-190).

were consistent with the general pattern suggested by the evidence for other countries, i.e., the contribution of the schooling component toward earnings inequality would tend to be smaller in developed countries than in developing countries. (Velloso 1975:69-73,123) Using a weighted sample from a survey of the Singapore manufacturing sector conducted in 1974, Liu and Wong (1978) found that their results were, to a large extent, consistent with the prediction of the human capital schooling model. (Liu and Wong 1978:6-10) Using data from thirty-two countries (eighteen of them developing), Winegarden estimated an income inequality equation in which he included mean and variance of (logarithm of) education attainment of adult population. He summarized the results by saying "..... the econometric evidence ..... firmly supports the proposition that higher average levels of schooling exert an equalizing effect" and "inequality in education attainment plays a larger role in generating income disparities than previous studies had revealed". (Winegarden 1979:83-87) A study by Psacharopoulos and Loxley using path analysis also provided ample evidence that education was a powerful determinant of both individual and group income differences. (Psacharopoulos and Woodhall 1985:267-268)

To sum up, these studies suggested that those countries with higher levels of education exhibited less income inequality. With respect to the dispersion of education, the studies reported that greater inequality of education attainments was associated with greater income inequality. Furthermore, the contribution of the schooling component toward earnings inequality tended to

be greater in developing countries than developed countries.

However, research in the United Kingdom suggested that equalizing the distribution of schooling might help to equalize the distribution of income within age groups, but it might make the distribution of income more unequal among the population as a whole. (Blaug et al. 1982) In addition, studies for several developing countries in intracountry and intertemporal contexts by Langoni (1972), Fislow (1973), Carnoy (1977), Fields (1978) and Jallude (1979) did not suggest a necessary alleviation of inequality as a result of an expansion of schooling[1].

Some studies which suggested a necessary alleviation of inequality as a result of an expansion of schooling are under criticisms. Ram criticized that neither studies of Chenery and Syrquin (1975) and Adelman and Morris (1973) investigated the effect of schooling inequality on income distribution. (Ram 1989:188-190) Velloso criticized the Adelman-Morris study because their "policy recommendations regarding the role of schooling in the reduction of inequality tended to be more loose than precise and their analysis of the topic is based essentially on ad hoc interpretations". (Velloso 1975:12)

Thus, more research not based on ad hoc interpretations is desirable for the examination of the effect of schooling on income size distribution.

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[1] See Fields (1980 pp. 283-284); Psacharopoulos and Woodhall (1985 pp. 269-271).

Empirical Approaches in Several Previous Studies

As mentioned above, both cross-section and intertemporal studies which relate schooling to income size distribution have been undertaken in developed and developing countries. Some of them are cross-country studies and some of them are intra-country studies.

No empirical studies of income size distribution can avoid the measures of inequality. However, there is no simple best approach to the measurement for the distribution of income. (Velloso 1975:242)

Sen classifies the measures of inequality into positive and normative ones. (Sen 1973:24-46) Since normative measures of inequality may provoke controversy, it may be better to concentrate our attention on the positive measures suggested by Sen.

Sen suggests several positive measures of inequality[1]. In comparing these measures, Sen observes that the real competition would be between such measures as the coefficient of variation, the standard deviation of logarithms and the Gini Coefficient. There are two advantages that make the standard deviation of logarithms the frequently used measure of inequality, according

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[1] They are the range, the relative mean deviation, the variance and the coefficient of variation, the standard deviation of logarithms, the Gini coefficient and Theil's entropy measure. See Sen (1973 pp. 24-46).

to Sen. One advantage of the logarithm, "in contrast with taking the variance or the standard deviation of actual values, is that it (the logarithmic transformation) eliminates the arbitrariness of the units and therefore of absolute levels". (Sen 1973:28-29) In contrast with the Gini Coefficient that measures absolute income differences, according to Velloso, this advantage of the logarithm also applies. (Velloso 1975:244)

More essentially, as noted by Kolm, there is a "principle of diminishing transfers" derived from a refinement of Pigou and Dalton's "principle of transfers". According to this principle, the impact is believed to be greater if the transfer takes place at a lower income level, for example, a transfer from a person with an income level of $1,000 to one with $900 is believed to have greater impact than a similar transfer from a man with $1,000,100 to one with $1,000,000[1]. Therefore, we need a measure of inequality which is more sensitive to transfers at the lower income level. The standard deviation of logarithms shows precisely the required type of sensitivity. This is another advantage of the logarithm.

Furthermore, the standard deviation permits no comparisons among different distributions but the standard deviation of logarithms does not have this deficiency since it is standardized by its mean[2].

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[1] See Kolm (1976 pp. 417; pp. 422) Sen has similar opinions. See Sen (1973 pp. 28-29; pp. 32).

[2] Velloso (1975 pp. 242) and Sen (1973 pp. 27) have similar ideas.

The standard deviation of logarithms of income has two more advantages over the Gini coefficient. The Gini coefficient measures the inequality among income groups but measures no inequality within income groups. However, the standard deviation of logarithms covers the inequality within income groups if individual earnings are used. In addition, the Gini coefficient requires income percentiles (or categories) to be computed while the standard deviation of log incomes does not. (Velloso 1975:242-243)

Velloso also observes that comparisons of the Gini coefficients over time within a country or among countries may serve only illustrative purposes unless the differences are substantial. This is because the coefficient is insensitive to small changes in income distribution. The same applies to cross-section comparisons among and within countries. (Velloso 1975:242-243)

To sum up, the standard deviation of logarithms is a commonly used measure of inequality which may distinguish itself from other positive measures of inequality if one wishes to attach greater importance to income transfers at the lower end.

No inequality can be measured properly without suitable and sufficient data. Data for the measurement of inequality in income size distribution are obviously personal incomes. Various definitions of personal income are possible, however, depending on the purpose of the inquiry. (Lydall 1976:15)

An obvious problem of defining the personal income is whether pre-tax income or post-tax income should be used. If our main purpose is to explain the distribution of earnings, in Lydall's opinion, we can do better by concentrating initially on the pre-tax distribution. (Lydall 1976:16)

Another obvious problem of defining the personal income is whether all incomes should be included. This is also a problem of defining the population to be covered by the distribution. It would be possible to produce thousands of different earnings distributions of widely varying shapes if we change the coverage. Therefore, it is desirable and necessary to select one or more of these distributions as the main object of the theoretical explanation. Lydall suggests that the income measured should be money wages and salaries only, and before tax. (Lydall 1976:17) Females are usually excluded because in contrast with males they exhibit a different labour participation pattern. Their potential years of working experience cannot be estimated with the Mincer model with the same degree of accuracy as that for males. (Chung 1990:5) Employers or family-workers should be excluded since earnings reported by employers or family-workers may not be commensurable to their own productivity. (Chung 1990:5)

It is time now to move from the dependent variable to the independent variables and the empirical approaches.

Various independent variables are included in the analytical

approaches used in the analyses of income size distribution. However, a study of income inequality which includes more explanatory variables does not necessarily mean that it can give more policy directions. (Ahluwalia 1974:18) Nevertheless, schooling is obviously one of the explanatory variables. (Ahluwalia 1974:18)

The effect of education on income size distribution can be examined by using the empirical framework derived from the human capital approach to distribution. The following are some of the studies using the human capital approach.

This first one is that of Chiswick and Mincer. This is a study of income size distribution using time-series data from the U.S. (Chiswick and Mincer 1972:S34-S66)

First of all, the Chiswick-Mincer study relates the income size distribution to the schooling variable as well as two standardizing variables, i.e., labour-market experience and stability of employment. Labour-market experience and stability of employment are obviously the variables of high explanatory power in any analyses of earnings. They are included in the earnings function not merely as the standardizing variables, according to Chiswick and Mincer. The two variables are considered to be derived from the human capital theory itself. Hence, they are not arbitrarily assigned.

Labour-market experience is incorporated into the equation

because it is regarded as a kind of investment in human capital. Stability of employment is incorporated into the equation because human capital theory predicts greater stability of employment for worker whose investments are firm specific. (Chiswick and Mincer 1972:S37)

Stability of employment is incorporated into the earnings function under the following rationale. If E_i^* is weekly earnings and W_i is the number of weeks worked per year, then $E_i^*(W_i)=E_i$, where E_i is the annual earnings. Since empirical results imply that average weekly wages are higher for those who work more weeks per year, therefore the elasticity of earnings with respect to weeks worked, γ, is incorporated into the equation to give an accurate measure of the annual earnings, i.e., $E_i = E_i^*(W_i)^{\gamma}$. By taking the natural log of both sides of the expression, we obtain $\ln E_i = \ln E_i^* + \gamma \ln W_i$. (Chiswick and Mincer 1972:S37)

The empirical framework is mainly shown in the statistical formulations as follows:

$$(\text{II-1})^1 \qquad \ln Y_i = x + r_i S_i + r_i' E_i + \gamma (\ln W_i) + U_i$$

where Y_i is the net earnings of individual i;

---

[1] In the original earnings function postulated by Chiswick and Mincer, there is a squared experience term. However, this term is deleted by Chiswick and Mincer when taking the variance of both sides of the earnings equation. This is because its inclusion would be computationally cumbersome and the addition to explanatory power is not likely to be large. (Chiswick and Mincer 1972:S38)

X is the constant intercept which can be interpreted as the average initial net earnings of individual i;

r_i is the average rate of return to each year of schooling of individual i;

S_i is the number of years of schooling received by individual i;

r'_i is the coefficient of experience of individual i;

E_i is the number of years of working experience of individual i which is measured as A_i-S_i-C where A_i is the age of individual i and C is a constant which represents the average age at the beginning of schooling;

γ is the elasticity of earnings with respect to weeks worked and is assumed constant across individuals;

W_i is stability of employment which is measured as the number of weeks worked;

U_i is the residual which reflects individual differences in earnings for given levels of

schooling, age and employment. It includes the effects of discrimination, differences in the nonpecuniary aspects of jobs, nonlabour income (if the net earnings, Y_i, include nonlabour income) and errors of measurement. The residual is assumed a random variable.

By taking the variance of both sides of equation (II-1), we can express relative-income inequality as a function of schooling, age, employment and rate-of-return parameters[1]. Thus, the relative-income inequality function is as follows:

$$
\begin{aligned}
(\text{II-2}) \qquad Var(\ln Y)^2 = {} & [(\bar{r}-\bar{r}')^2 + Var(r) + Var(r')]\, Var(s) \\
& + [(\bar{r}')^2 + Var(r')]\, Var(A) + \gamma^2 Var(\ln W) \\
& + 2[\bar{r}'(\bar{r}-\bar{r}') - Var(r')]\, R_{as} SD(A)\, SD(S) \\
& + 2\, SD(\bar{r}-\bar{r}')\, R_{sw} SD(S)\, SD(\ln W) \\
& + 2\, SD\bar{r}'\, R_{aw} SD(A)\, SD(\ln W) \\
& + Var(r)\,\bar{S}^2 + Var(r')\,(\bar{A}-\bar{S}-5)^2 + Var(U)
\end{aligned}
$$

Chiswick and Mincer then further simplify the equation (II-2) by assuming r_i and r'_i constant across individuals[3]. The simplified equation is as follows:

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[1] The rate of return to schooling, $\bar{r}$, is assumed a random variable independent of the level of schooling. The coefficient of experience is assumed a random variable independent of the level of experience. It is also assumed the $\bar{r}$ and $\bar{r}'$ are uncorrelated. (Chiswick and Mincer, 1972:S39)

[2] Becker and Chiswick consider that the variance of the natural log of earnings, one of the most commonly used measures of income inequality, is not just arbitrarily introduced but is derived from the theory itself. (Becker and Chiswick, 1966 pp. 364).

[3] Since $\bar{r}$ and $\bar{r}'$ are assumed constant, Var ($\bar{r}$) = Var ($\bar{r}'$) = 0 and therefore several terms of equation (II-2) can be deleted.

(II-3) $$Var(\ln Y) = (\bar{r}-\bar{r}')^2 Var(S) + (\bar{r}')^2 Var(A) + \gamma^2 Var(\ln W) + 2[\bar{r}'(\bar{r}-\bar{r}')] R_{as} SD(A) SD(S) + 2\gamma(\bar{r}-\bar{r}') R_{sw} SD(S) SD(\ln W) + 2\gamma \bar{r}' R_{aw} SD(A) SD(\ln W) + Var(u)$$

$$Let\ M = (\bar{r}-\bar{r}')^2 Var(S) + (\bar{r}')^2 Var(A) + \gamma^2 Var(\ln W) + 2[\bar{r}'(\bar{r}-\bar{r}')] R_{as} SD(A) SD(S) + 2\gamma(\bar{r}-\bar{r}') R_{sw} SD(S) SD(\ln W) + 2\gamma \bar{r}' R_{aw} SD(A) SD(\ln W)$$

(II-4) Hence, $$R^2 = \frac{Explained\ Inequality}{Observed\ Inequality} = \frac{M}{Var(\ln Y)}$$

The relative-income inequality is now decomposed into parts attributable to the human-capital and employment variables by means of the earnings inequality function. (Chiswick and Mincer 1972 S41) In the earnings inequality function [equation (II-3)], the terms $(\bar{r}-\bar{r}')^2$Var(S), $(\bar{r}')^2$Var(A) and γ^2Var(ln W) approximate the contributions of schooling, age and employment to earnings inequality, respectively. Thus, the contributions of schooling, age and employment to inequality of earnings can be identified.

The Chiswick-Mincer study also incorporates the covariances involving schooling, age and employment into the earnings inequality function since the study assumes intercorrelations between the explanatory variables. The covariances are the covariance of schooling and age[1], the covariance of schooling

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[1] Covariance of schooling and age = $2[\bar{r}'(\bar{r}-\bar{r}')] R_{as} SD(A) SD(S)$ [see equation (II-3)].

and employment[1], and the covariance of age and employment[2]. These covariances have economic meaning. (Chiswick and Mincer 1972:S40-41) They are interpreted as the joint contributions of the explanatory variables toward the earnings inequality. If they are found to be positive, their effects on the distribution of earnings are also considered positive, that is, inequality increases when the covariances become more positive. On the other hand, if they are found to be negative, their effects on the distribution of earnings are considered negative, that is, inequality decreases when the covariances become more negative.

According to the human capital interpretation, a negative correlation between age and schooling reflects a secular trend in schooling. Upward secular trends in schooling have a narrowing effect on earnings inequality. This is because the young, whose few prior but relatively large contemporaneous investments would lead to lower their net earnings, also have greater than average schooling which tends to raise their earnings. In other words, inequality decreases when the trend in schooling increases, that is, when R_{as} becomes more negative. (Chiswick and Mincer 1972:S40-41)

The human capital interpretation of the relationship between schooling and weeks worked or between age and weeks worked would lead us to expect a positive value for R_{sw} and R_{aw}. Accordingly, the two covariances would have positive effects on earnings

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1 Covariance of schooling and employment = $2\gamma(\bar{r}-\bar{r}')R_{sw}SD(S)\,SD(\ln W)$ [see equation (II-3)]

2 Covariance of age and employment = $2\gamma\bar{r}'R_{aw}SD(A)\,SD(\ln W)$ [see equation (II-3)]

inequality. These can be explained by both supply of labour and demand for labour factors. On the demand side, increased investments in specific training with higher levels of schooling and age, until older ages, diminish the firm's incentive to lay off such workers, and thereby increase the number of weeks worked. On the supply side, investments specific to the firm (for example, training and nonvested pension funds) also increase with schooling and age, again until older ages, thereby lowering quit rates. Those with larger school and post-school investments have a greater opportunity cost of time and would tend to economize on job search, thereby working more weeks per year. In addition, as noted by Chiswick and Mincer,there are lower levels of weeks worked of the young workers. This may be due to the searching for information about the nature of jobs of the young workers. (Chiswick and Mincer 1972:S40-41)

Chiswick and Mincer also estimated the effect of a unit change in the explanatory variables on the inequality of earnings by introducing partial derivatives of Var (ln Y) with respect to the variables of interest. The partial derivatives are made on the qualification that all other things remain unchanged, i.e., the residual variables and other explanatory variables remain unchanged. It should be noted that arguments that depend on the **ceteris paribus** qualification are common in economics. (Lipsey 1976:38)

Finally, this inter-temporal study indicates that schooling has a contribution to income size distribution. However, the

results also indicate that the stability of employment contributes much more to income size distribution than schooling. (Chiswick and Mincer 1972:S42)

Velloso tried to apply the Chiswick-Mincer model to Brazil, a developing country in Southern America. The basic source of data used in the study was the 1.27 per cent of the sample of the demographic census of Brazil in 1970. The population under study was restricted to non-enrolled Brazilian civilian males in the urban labour force. The population was further restricted to persons aged fourteen and over and aged sixty and under with money income. Illiterates were also excluded from the sample when the distribution of earnings was studied from a human capital approach. Earnings were approximated by the income reported to the census since he further restricted his population under study to employees and self-employed professional workers, excluding employers and other self-employed persons. Average monthly income reported was multiplied by twelve to obtain an annual measure of the earnings variable. (Velloso 1975:Chapter III)

As Carnoy observes, the Velloso model is basically the same as the Chiswick-Mincer model. (Carnoy 1979:41) However, Velloso introduces modifications to the model[1]. One of these

[1] "In the Chiswick - Mincer formulation, costs of schooling and post-school investments were viewed as a fraction k of income that would be earned if the individual were not investing (potential earnings), and this function was assumed constant across individuals and levels of schooling." (Carnoy 1979:36) Due to data limitations, the Chiswick - Mincer model further assumes that the fraction k is equal to 1 for the schooling years. (Chiswick and Mincer 1972:S36-S37) Hence, years of schooling are used as an empirical approximation of schooling investments in the Chiswick-Mincer model. However, the Brazilian data allow Velloso to adopt a less restrictive assumption that the ratio of total investment costs of schooling to potential earnings (k) varies across levels of schooling. Hence, the empirical approximation of schooling investments is adjusted by the k ratio

modifications is that Velloso uses an alternative specification of the earnings function where age is directly used as a proxy for experience as follows:

(II-5) $$\ln Y_i = x + r_i I_i + r_i' A_i + \gamma (\ln L_i) + U_i$$

where I_i is the investments in schooling of individual i[1];

A_i is the age of individual i;

L_i is the stability of employment which is measured as the number of months worked of individual i and other variables are as defined in equation (II-1)

The empirical approximation for experience in the Chiswick - Mincer model is $A_i - S_i - C$ where the variables are as previously defined. "In the aggregate data for Brazil, where direct information on years of experience is not available, the empirical approximation for this variable is strongly correlated with age. Increases in age represent average work experience increase and thus Velloso views age as a proxy for experience. He finds additional support for this interpretation in the statistical procedure used to estimate the coefficient of age in his earnings function." (Carnoy 1979:36) The results show that the estimated coefficients of age in equation (II-5) and experience in equation (II-1) are identical. This identity can

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(cont.) in the Velloso model. (Velloso 1975 pp. 36-37; Carnoy 1979 pp. 36)

[1] See footnote 1 in pp.35.

be explained as follows: when we run the regression equation (II-1) to estimate the parameter of the experience variable, we are statistically holding constant the schooling variable. Note that the experience variable is simply measured by age minus years of schooling minus a constant[1]. Therefore, "when schooling is held constant, relative earnings increases due to a one unit increase in age are the same as those due to a one unit increase in experience, but the intercept shifts downwards." (Velloso 1975:61-62) Therefore, Velloso concludes that either of the specifications of the earnings function would yield the same information regarding the average returns to post-school investments. (Carnoy 1979:37)

However, the empirical approximation for experience is, by definition, correlated with the schooling variable. This introduces collinearity problems in Velloso's estimates and, therefore, the specification (II-5) using age as a proxy for experience is preferable to (II-1). Velloso also points out that Chiswick and Mincer disaggregate the experience variable into its components (age, schooling) when deriving the earnings inequality function [equation (II-2)]. Thus, Chiswick and Mincer circumvent the problem of an overestimation of the contribution of the schooling component. (Velloso 1975:64) The use of equation (II-1) and equation (II-3) "means that while the regression estimates of Chiswick and Mincer are for the model that uses schooling and <u>experience</u>, the contributions of the relevant variables toward

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[1] This constant stands for the average age at the beginning of schooling of the population. See Chiswick and Mincer (1972 S38)

earnings inequality are actually those of the model which uses schooling and age." (Velloso 1975:65)

Velloso also indicates that replacing the empirical approximation of experience by age in the specification of the earnings function yields a relatively smaller value for the estimated average rate of return to schooling. (Velloso 1975:57) However, he asserts that since socio-economic background is excluded from the earnings function and since this variable is positively associated with schooling investments, the coefficient of schooling is biased upwards[1]. " These are effects which tend to offset each other." Thus, it is possible that the specification which introduces age as a proxy for experience yields an adequate value for the rate of return to schooling. (Velloso 1975:219)

Therefore, Velloso concludes that "in short, if we use the specification containing the age variable we obtain more accurate estimates of the true contribution of schooling in the earnings inequality function. In addition, this is a simpler procedure than the technique that estimates the parameters on one earnings function and later adjusts the results in the earnings inequality function, making them correspond to those of an alternative specification of the earnings function." (Velloso 1975:65) In other words, he use equation (II-5) as the empirical specification of the earnings function. The earnings inequality function is therefore obtained by taking the variance of both

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[1] In a regression equation, if the coefficient of a variable X_i is positive and if this variable is positively correlated with a left-out variable Z_i, then the estimated coefficient of X_i will be biased upwards. (Kmenta 1971 pp. 391-395)

sides of (II-5). If r^* and r' are considered as parameters, i.e., as an approximation to the average rate of return to school and post-school investments, we obtain:

$$
\begin{aligned}
(\text{II-6}) \qquad Var(\ln Y) = {} & (r^*)^2 Var(I) \\
& + (r')^2 Var(A) \\
& + \gamma^2 Var(\ln L) \\
& + 2 r^* r' R_{ia} SD(I)\, SD(A) \\
& + 2 r^* \gamma R_{il} SD(I)\, SD(\ln L) \\
& + 2 r' \gamma R_{al} SD(A)\, SD(\ln L) + Var(U)
\end{aligned}
$$

Using this empirical specification of the earnings inequality function, therfore, the effects of the explanatory variables on the distribution of earnings can be analyzed for the Brazilian data. A preliminary test obtained from the partial slopes yielded by the regression equation (II-5) is also undertaken. It is found that the coefficient of the schooling variable is positive and significantly different from zero at the 0.001 level. It is also found that there is a positive and sizeable contribution of the schooling component to the earnings inequality for Brazil. These results substantiate the human capital hypothesis of a positive and significant contribution of the distribution of schooling toward the earnings inequality. (Velloso 1975:70; Carnoy 1979:40,100) This implies that in the aggregate, other things being constant, as the variance of the schooling investments in the labour force increases, so does the relative inequality of earnings. Similarly, it is found that the coefficients of the variables of post-school investments and employment are also positive and significantly different from zero at the 0.001 level. It is also found that there is a positive but comparatively smaller contributions of the post-

school investments and employment to the earnings inequality. These results therefore also substantiate the human capital hypothesis of positive and (statistically) significant contributions of post-school investments and employment toward earnings inequality in Brazil. This implies that in the aggregate, other things being constant, as the variance of post-school investments (approximated by the variance of age) increases, so does the relative inequality of earnings. Under a similar **ceteris paribus** assumption the same inference is valid for the relative distribution of employment. (Velloso 1975:70) The earnings inequality function also indicates that the higher the average rate of return to investments in schooling, the larger the inequality of earnings. In other words, for the same distribution of schooling investments, as the average payoff to these investments rises, the distribution of income becomes more unequal. (Velloso 1975:70-71)

The results show that the correlation of age with schooling is weak and positive but the correlation of age with the employment (total months worked) is very small (virtually zero) and negative. (Velloso 1975:94-97) The correlation of schooling and employment is also very small and negative. (Velloso 1975:98)

The results about the correlation of age and employment and that of schooling and employment can be suggestive only, according to Velloso. (Velloso 1975:97-98)

Finally, Velloso concludes that "within a human capital

context, two policy options emerge for a reduction or for a lower rate of increase in inequality in the decade ahead: changes in the pattern of the expansion of schooling supply and/or a decrease in the differences between the rates of return to upper and lower levels of schooling." (Velloso 1975:191) Changes in the pattern of the expansion of schooling supply refer to a reduction in the inequality of schooling by "a more rapid expansion of elementary and lower secondary schooling relative to the expansion of upper levels." (Velloso 1975:191)

Liu and Wong also apply the human capital approach to distribution to Singapore, an Asian developing country. Their study used a random stratified sample of 1019 male workers of the Singapore manufacturing sector in 1973. They sort out effects of schooling and post-school investments by applying the schooling model [equation (II-7)] to the "overtaking set". (Liu and Wong 1978:5) According to Mincer, when a young worker starts working , he usually accepts lower earnings than his earnings-potential originated from schooling, if he regards this as a form of investment in on-the-job training and anticipates greater earnings in the future. His observed earnings will rise and finally overtake his schooling earnings-potential. It is during this "overtaking" period that his observed earnings equal his potential earnings from schooling. (Mincer 1974:11-18; Chung 1990:6) This implies that the explanatory power of schooling in accounting for earnings inequality would be at its maximum in the overtaking experience group. (Mincer 1974: xiv, 11-18; Liu and Wong 1978: 5) Thus, Liu and Wong apply the schooling model

equation to the overtaking set for the Singapore data. The schooling model equation is as follows:

(II-7) $$\ln Y = \ln Y_o + rS$$

where Y_s is the potential earnings of an individual with S years of schooling; Y_o is the earnings of an individual with O year of schooling; r is the rate of return to schooling; S is the completed years of schooling. (Liu and Wong 1978:4)

They further express the schooling model [equation (II-7)] in the variance from by using the theorem due to Goodman (1960). If variations in the rate of return to schooling are ignored and the rate of return to schooling is assumed uncorrelated with the level of schooling, the variance form of the schooling model becomes:

(II-8) $$Var(\ln Y_s) = \overline{r}^2 Var(S)$$

Equation (II-8) "predicts that the variance of log wages would be larger the greater is the variance in years of schooling." (Liu and Wong 1978:6) This pattern is clearly borne out by the results of Liu and Wong's study. The results also show that the overtaking period is 7 to 9 years of experience[1] for the Singapore data. Schooling alone explains about 60% of the variation in lnY in the overtaking period. This is actually

[1] The overtaking period is 7 to 9 years of experience for the U. S. (Mincer 1974) It is 10 to 13 years of experience for Hong Kong, according to Liu and Wong (1978). Using data from Hong Kong in 1976, Kwok (1984) reported that the overtaking period is 4 to 7 years of experience. It should be noted that Kwok's focus is not on the dispersion in earnings.

higher than the explanatory power of schooling alone for other experience groups. (Liu and Wong 1978:6-9)

Liu and Wong also observe that "in a rapidly developing country like Singapore in which expansion and modernization of the education system is pervasive, most individuals with less schooling tend to belong to an earlier cohort." (Liu and Wong 1978:23)

To sum up, both cross-section and intertemporal studies which relate schooling to income size distribution have been undertaken in developed and developing countries. Some of them are cross-country studies and some of them are intra-country studies. The variance of logarithms is a commonly used measure of income inequality. The coverage of a distribution of labour income for analysis usually excludes female, employers and family-workers. The income measured should be before tax. The effect of education on income size distribution can be examined by using the empirical framework derived from the human capital approach to distribution.

Chapter III

The Study

The Theoretical Framework

Schooling and Human Capital

The study of the schooling effect on distribution of labour income may use a variety of theoretical framework, many of which are often ad hoc generalizations. The theoretical framework used in this study is based on the human capital model[1].

Broadly speaking, the rationale is as follows: when wages are paid according to marginal product[2], the skills, as imparted by schooling, are assumed to lead to higher productivity and, thus, to higher earnings. Therefore, the stock of schooling embodied in an individual is a source of human capital. Empirically, schooling has often been considered a major source of human capital. Since schooling most often occurs before individuals join the labour market, the stock of schooling embodied in an individual is therefore considered a cause rather than a result of his earnings.

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1 Human capital model was also adopted in analyses of labour income in Hong Kong by Liu and Wong (1978), Kwok (1984) and Chung (1990).

2 The marginal product is not necessarily restricted to the individual. It can refer to the average marginal product of the occupation of the workers or even the lifetime marginal products rather than their own marginal product. (Thurow 1970 pp. 15-21; Becker 1964 pp. 47; Mincer 1974 pp. 65).

Human Capital and Income Size Distribution

Differences of the amount of human capital acquired by the workers generate differences in labour productivity. Differences in labour productivity therefore generate variations in labour income, according to human capital theory. Schooling is considered one of the major sources of human capital. Therefore, if one wishes to reduce income inequality, one way to achieve this would be to reduce inequality in the investments in schooling. (Cohn 1979:28-32)

Schooling raises an individual's productivity and therefore his earnings, according to the theory of human capital. One may predict that everyone wants to earn more and therefore everyone wants to receive education so as to raise his productivity or the earning power. The fact that everyone wants to receive more education reduces the total supply of workers of low skill, which leads in turn to an increase in the labour income of the workers of low skill. On the other hand, the total supply of workers of high skill is therefore increased, which lowers the labour income of the workers of high skill. The net result is that total output rises and the distribution of labour incomes becomes more equal. (Thurow 1972:66-81)

Human capital theory, however, brings us farther than this. The argument is more fundamental: by its very nature human capital is considered less prone to income concentration than other kinds of capital. Reasons for this recommendation are i)

expansion in the stock of human capital, unlike physical capital, necessarily involves dispersion across a wider population; ii) accumulation of human capital in a single person has a limit; iii) human capital cannot be bequeathed across generations in the same manner as physical capital. (Ahluwalia 1976:307-342) T.W. Schultz also points out that a more rapid increase in human capital, relative to conventional (physical) capital, leads to greater equality in overall income distribution. (Schultz 1963:65) Since schooling is considered a major source of human capital, a rapid expansion in schooling instead of other nonhuman capital will therefore alleviate the overall income inequality.

As mentioned in previous chapters, a persisting demand for educated labour probably creates a favourable environment for schooling to play its role in income size distribution. Underemployment or unemployment of educated labour will undermine the schooling effect on income size distribution. It is therefore conceivable that the relevance of the human capital approach to education is much greater in developing countries where there is a marked demand for educated or trained labour. In these countries, an adequate supply of educated or skilled labour is a necessary condition of any sustained expansion in output and would be part of any growth-oriented strategy. (Ahluwalia et al. 1974:82)

The human capital theory also provides a rigorous definition of the seldom defined concept of "equality of opportunity". In the framework of this theory, the concept of "equality of

opportunity" can be defined "as a situation in which low parental wealth and other supply disadvantages were sufficiently offset so that the effective supply curve of funds was the same to everyone." The elimination of unequal supply conditions "would reduce the inequality in investments in human capital and therefore the inequality in incomes". (Becker and Chiswick 1966:362)

The role of education in equalizing the income distribution is considered intuitively defensible because an inequality of schooling is always viewed as an inequality of opportunity and equalizing opportunity seems likely to increase aggregate income, rather than reducing it. (Rivlin 1975:3)

Human capital theory also predicts that a reduction in inequality of opportunity is likely to lead to greater efficiency and greater equality in earnings, if inequality of opportunity dominates and if the correlation between ability and opportunity is far from perfect. (Mincer 1970:21)

Under the same approach, work experience may also play its role in income size distribution as a kind of human capital if it is conducive to increase in productivity.

A natural consequence of the concepts outlined above is a theoretical framework for the distribution of earnings as a function of the distribution of investments in (a) schooling and (b) experience and (c) the average level of the rate of return

to such investments. A simple heuristic interpretation of the relationships can be made as below. If we suppose a single average rate of return to investments in schooling, then a more unequal distribution of such investments corresponds to a more unequal distribution of earnings. Similarly, for a given distribution of investments, the higher the average rate of return, the more unequal is the distribution of earnings. The extension of the rationale for the distribution of investments in experience and their average rates of return can be made along the same lines.

A formalization of these theoretical constructs concerning schooling is found in the works of Becker (1964, pp. 61-66; 1967, pp. 12-27), Becker and Chiswick (1966, pp. 358-69), and Chiswick and Mincer (1972, pp. S34-S66). In these works, earnings of an individual are postulated dependent on the amount invested in human capital, assuming that each individual invests the amount that maximizes his economic welfare.

Education Expansion and Cohort Differences in Schooling

Schooling has been considered a public good. However, education expansion is unlikely to be enjoyed by every citizen. As long as there is economic progress, obsolescence of old skills and knowledge are unavoidable. However, investments in schooling are made over a considerable length of time and are predominantly made at young ages. (Liu and Wong 1978:25) Few people will return to school after they have many years of work experience

even if their level of schooling is relatively low. Schooling can never improve an individual's earnings if he is deprived of the opportunities to improve his schooling. Furthermore, people tend to learn more from schooling when they are young. Schooling is likely to improve less productivity or labour power for the aged. These mean that older cohorts are precluded from enjoying the benefits of an expanding education system with direct effects on their future earnings. (Liu and Wong 1978:25) Therefore, education expansion is helpless for the income size distribution of the population who complete their schooling before the expansion. A natural consequence of the human capital concepts outlined above is a prediction that there will be an unequal income size distribution of the population who complete their schooling before the education expansion. This is because the schooling opportunities are limited and unequally distributed before the education expansion. On the other hand, there will be a more equal income size distribution of the population who receive their schooling after the education expansion because the schooling opportunities are readily available and more equally distributed.

To sum up, when an analysis is conducted from a human capital perspective, it can be expected that, other things being equal, the inequality in earnings will be positively related to the distribution of schooling as well as to the level of rates of return to schooling.

The Hong Kong Context

As noted in Chapter One, Hong Kong is a suitable place for an assessment of the schooling effect on income size distribution. The background for this opinion has been outlined in that chapter. This section is trying to elaborate on the essential features of Hong Kong which provide a suitable context for this study.

Dore praises Hong Kong very much for its emergence as a place where "most men's income and status have depended on what they actually know and can do - on their skills and their push and intelligence". (Dore 1976:73) In other words, in Dore's opinion, people in Hong Kong are paid according to their skills, knowledge and performance. If Dore's observation is true, then people with more schooling are likely to earn more than people with less schooling in Hong Kong.

The economy of Hong Kong has grown very rapidly. Over the ten year period from 1976 to 1986, on average, real GDP grew by about 8% per year. Real GDP per capita grew from HK$19,895 in 1976 to HK$35,604 in 1986 (at 1980 = 100 constant price, dollar value pegged at US$1 = HK$7.8 since 1983). It has grown by about 80% over the ten year period. (Chung 1990:8)

The unemployment rates for male have been low in Hong Kong for a long time. The overall unemployment rates for males reported in the Census in 1976, 1981 and 1986 are 4.8%, 4.1% and

3% respectively. (Chung 1990:5)

It should be noted that the total labour force has grown from 1,895 thousand in 1976 to 2,702 thousand in 1986. However, employment in the different sectors of the economy did not grow by the same proportion. The total employment has grown from 773.7 thousand to 865.6 thousand by 11.9% in the manufacturing sector, and from 72.5 thousand to 194.3 thousand by 168% in the business and finance sector. (Chung 1990:8) These figures show that business and financial sectors which require better educated labour have rapidly and drastically expanded over the ten year period.

The employment growth was also not the same among the various occupations in Hong Kong during the period of fast economic growth. The proportion of professional and technical workers has increased by more than double, from 6.02% in 1976 to 12.49% in 1986, while the proportion of production and related workers has decreased drastically from 56.50% to 37.56%. The proportions of clerical and service workers have increased significantly, from 14.79% and 13.56% to 18.46% and 17.28%, respectively. The proportion of administrative and managerial workers also grew from 1.44% in 1976 to 2.21% in 1986. (Chung 1990:9) These figures show that the proportion of the workers in the occupations which require better education or training has drastically increased over the ten year period.

The expansion of the business and financial sectors and the

rapid change of the employment structure indicate that there is a persisting demand for educated or trained labour. Even in the manufacturing sector, the future export earnings would be more based on the application of knowledge and skills than labour assembly work due to the expansion of low-cost, labour-based production capacity in the rival countries of Hong Kong in the Asia Pacific region.

Chung also observes that the rate of return to university education has slightly increased from 22.5% in 1976 to 23.3% in 1986[1]. This reflects that there is a persisting demand for highly educated labour. Furthermore, 65% of the working population with university education in 1986 were graduates overseas. These graduates, except for those of medical professions, receive earnings not lower than the local graduates. This indicates that the demand for highly educated labour is so great that even graduates with overseas qualifications are also absorbed in large amounts by the labour market of Hong Kong[2]. The élite approach to post-secondary education adopted by the Hong Kong government may contribute to the shortage of highly educated labour until the late eighties[3].

As noted in previous paragraphs, a persisting demand for educated labour probably creates a favourable environment for schooling to play its role in income size distribution.

1,2 參看鍾宇平 (1990) 〈港府應大幅擴展大學教育嗎？——本港大學畢業勞動力供求情況探討〉，《明報月刊》第25卷第3期頁53.

3 Only about 2% of the relevant age group secure a university place in Hong Kong. See A Perspective on Education in Hong Kong: Report By A Visiting Panel. (Llewellyn et al. 1982 pp.65)

Therefore, schooling may have an effect on income size distribution in Hong Kong.

More essentially, there is a rapid education expansion in Hong Kong. The government of Hong Kong introduced universal primary education not later than 1971. In 1978, however, all pupils in Hong Kong enjoyed universal junior secondary education. By the early 1980's, over 85 per cent of 16-year old population received their senior secondary education. The following tables and figures summarize the rapid development of education in Hong Kong over the past decades.

TABLE III-1

ENROLLMENT SUMMARY[1]
(PRIMARY ONE AND FORM ONE)
HONG KONG, 1959-1971

Year	Primary One	Form One
1959	68980	17556
1960	85438	20872
1961	98953	26407
1962	120608	34127
1963	135073	39725
1964	133233	50802
1965	153967	52477
1966	164885	52926
1967	167448	57849
1968	168711	59875
1969	166745	78864
1970	146831	69176
1971	138683	73733

[1] Data Source: Annual Reports (1949-1951, 1959-1971) Education Department, Hong Kong Government.

FIGURE III-1

TOTAL ENROLLMENT IN PRIMARY SCHOOLS (DAY/EVENING) (1946-82)[1]

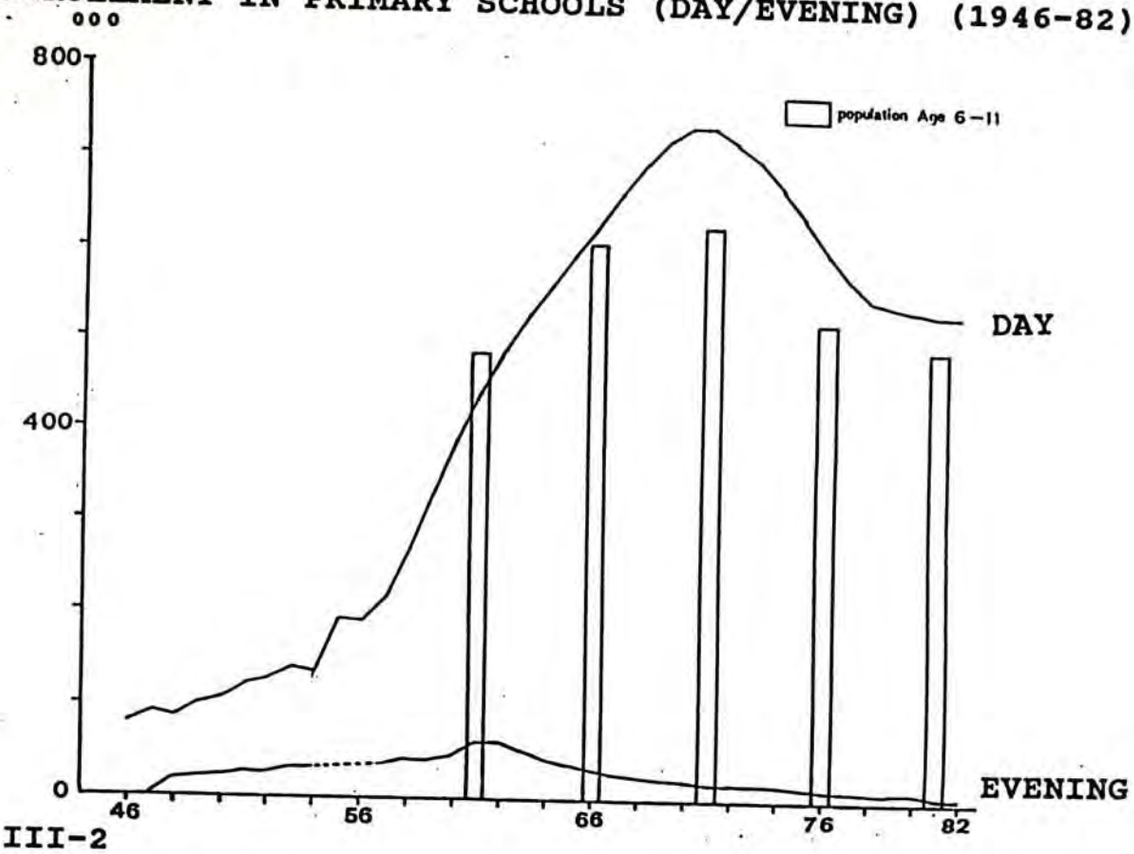
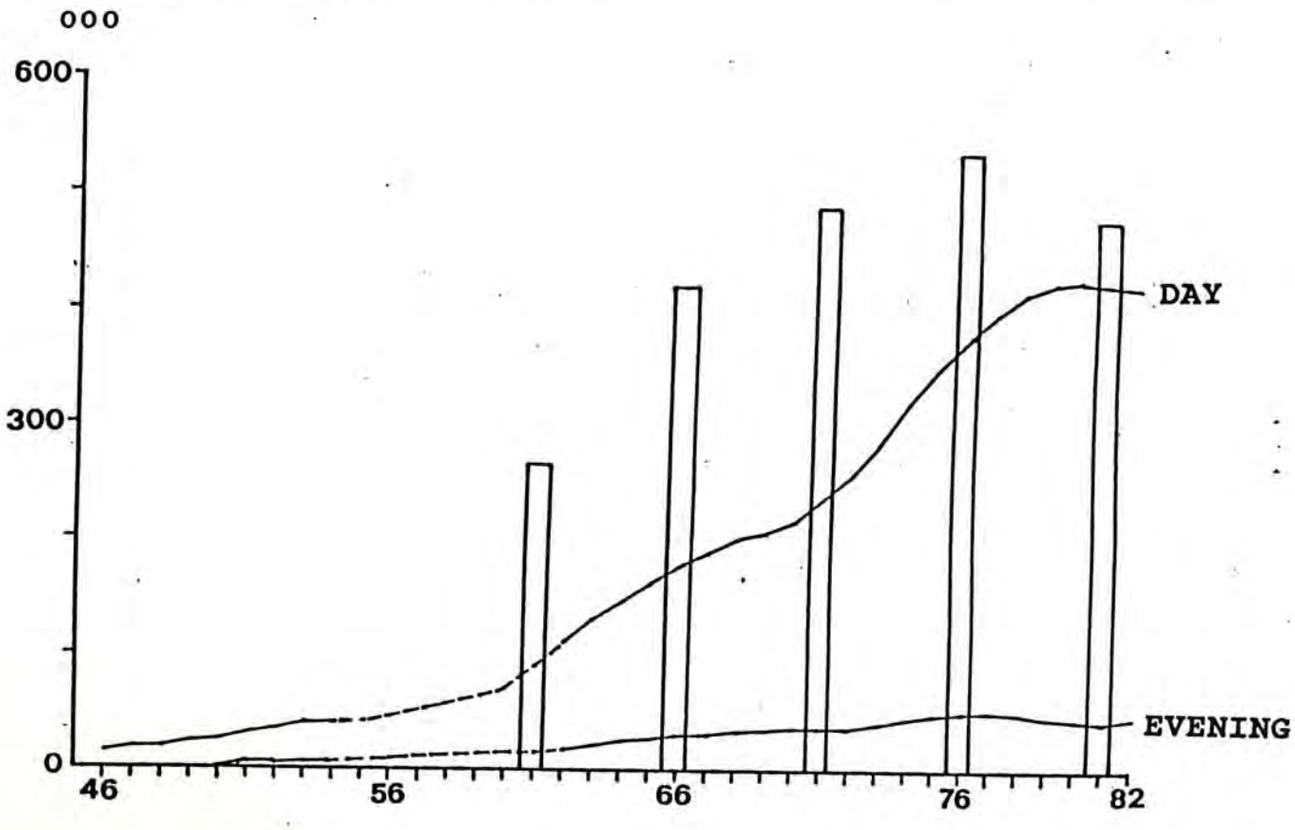


FIGURE III-2

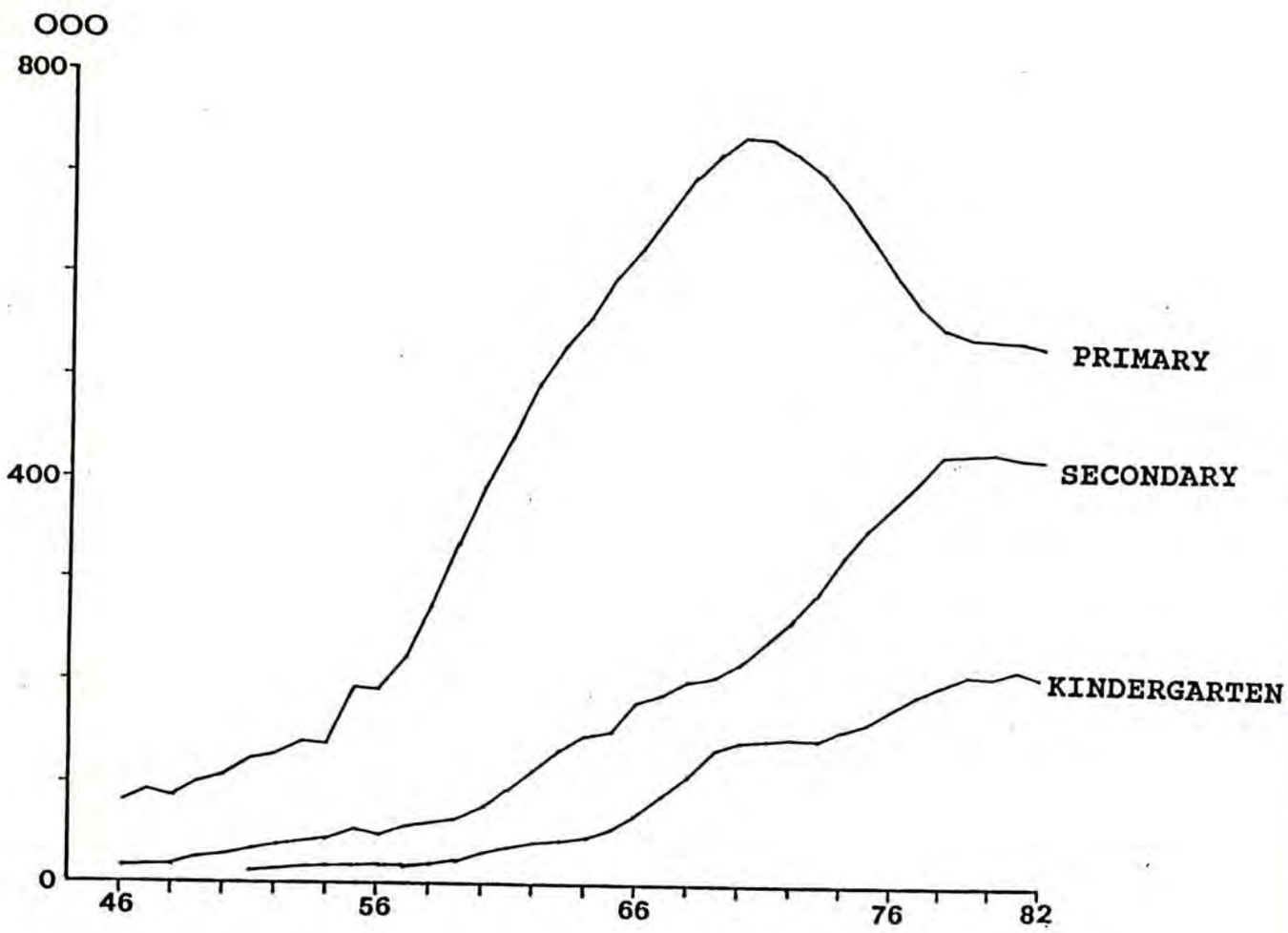
TOTAL ENROLLMENT IN SECONDARY EDUCATION (DAY/EVENING) VERSUS POPULATION AGED 12-16 (1946-82)[2]



1,2 See Luk & Wu (1983 fig. 1.22, 2.11-2.15)

FIGURE III-3

ENROLLMENT IN KINDERGARTEN, PRIMARY, & SECONDARY DAY SCHOOLS (1946-82)[1]



Based on Table III-1 and figure III-1, one can observe that the early sixties is probably the turning point of the development of the primary education in Hong Kong. From the early sixties, the aggregate enrollment in primary education was increasing rapidly. Based on figure III-2 and III-3 one can observe that the early seventies is probably the turning point

[1] See Luk & Wu (1983 fig. 4.1)

of the development of the lower secondary education in Hong Kong. During that time, the aggregate enrollment in lower secondary education was going up rapidly. This interpretation is further corroborated by the dramatic increase of the enrollment in Form One classes during that period (See Table III-1). These dramatic increases in enrollment, however, occurred in primary and lower secondary education only. The development in tertiary education was comparatively stagnant in Hong Kong until the late eighties.

The rapid expansion in primary and lower secondary education over the past decades has drastically changed the pattern of the distribution of schooling in Hong Kong. The proportion of the people who attended kindergarten or below of the whole population has drastically decreased from 39% in 1961 to 20% in 1986, while the proportion of the people with secondary schooling has increased from 14% to 38%. However, the proportion of graduates with tertiary education remained low though it also slightly increased in both years. This is because the rate of expansion of tertiary education was strictly controlled by the government during the past decades. The pattern of these education changes over the past decades indicates that there is a more rapid expansion of primary and lower secondary schooling when compared with the expansion of upper levels. According to Velloso, such a pattern of education expansion would lead to a reduction in inequality of schooling and, thus, reduce the earnings inequality. (Velloso 1975:191) These education changes can be illustrated by the following table:

TABLE III-2

EDUCATIONAL ATTAINMENT OF THE WHOLE POPULATION (PERCENTAGES), HONG KONG, 1961-1986[1]

	A	B	C	D	E	F	G
1961	39	3	42	14	/	1	1
1966	35	4	41	17	/	2	1
1971	28	3	45	21	/	2	1
1976	26	/	43	27	2	/	2
1981	22	/	37	33	3	3	3
1986	20	/	33	38	4	2	3

Key **A=Kindergarten or below** **E=matriculation**

B=private tutor **F=post-secondary education**

C=primary education **G=university**

D=secondary education

In short, Hong Kong as the context of this study is characterized by a rapid economic development, a rapid expansion in primary and lower secondary schooling and a persisting demand for educated labour.

[1] Data Source: Luk & Wu (1983 fig. 5.13) and Hong Kong 1986 By-Census: Main Report Volume 2 (Census and Statistics Department 1987)

The Research Hypotheses

The main purpose of the present study is trying to examine the effect of schooling on the distribution of earnings in Hong Kong, a rapidly developing LDC.

The following are the hypotheses which will be tested in the study.

Hypothesis One: There is a significant effect of schooling on the earnings inequality in the aggregate set.

Hypothesis Two: There is a significant effect of schooling on the earnings inequality in the overtaking set.

The study also tests the essential human capital hypothesis that schooling is, **ceteris paribus**, positively and significantly related to individual earnings in both the aggregate and overtaking sets.

The Empirical Specification of the Model

The Earnings Inequality Function

The model used to test Hypothesis One in this study is derived from the human capital earnings function[1]. The statistical formulation given below follows the essentials of the human capital earnings function and includes all the variables relevant to this study. Let the specification of the earnings function be (the subscripts i are deleted):

(III-1) $$\ln Y = \alpha + rS + r'E + \gamma (\ln W) + U$$

where
- S = years of schooling;
- E = work experience;
- lnW = employment variable;
- U = the residual variable which reflects individual differences in earnings for given level of investments in schooling, age and employment. It includes the effects of discrimination, differences in the nonpecuniary aspects of jobs and errors of measurement. The residual is assumed a random variable.

As it is in the case of the Velloso study (1975), direct

[1] The human capital earnings function was initially postulated by Becker and Chiswick and later developed by Mincer and by Chiswick and Mincer. See Becker and Chiswick (1966) and Mincer (1970 pp.1-26)

information on years of experience in the aggregate data is not available in this study. Usually work experience in (III-1) is substituted for its empirical approximation to solve this problem. The empirical approximation is E=(A-S-C) where A stands for age, S stands for years of schooling and C is the average age in starting formal schooling. Substitute work experience in (III-1) for its empirical approximation, E=(A-S-C), we obtain

$$(III\text{-}1)' \quad \ln Y = \alpha + rS + r'(A-S-C) + \gamma(\ln W) + U' = (\alpha - r'C) + (r-r')S + r'A + \gamma(\ln W) + U'$$

where U' is the residual and is defined as in (III-1)

It can be observed in (III-1)' that the empirical approximation for experience is strongly correlated with age. "Increases in age represent average work experience increases" and thus age can be viewed as a proxy for experience. (Carnoy 1979: 36-37) If age is used instead of experience the specification of the earnings function is

$$(III\text{-}2) \quad \ln Y = \alpha^* + r^*s + r'A + \gamma(\ln W) + U'$$

where $\alpha^* = (\alpha + r'C)$ *and* $r^* = (r - r')$

We can observe that the coefficient of experience variable in (III-1) is indeed the same as that of the age variable in (III-2) when the experience variable is disaggregated into its components

(i.e. age and schooling). This identity[1] between the coefficients of age and experience can be proved by the regression results. Ordinary least squares estimates of the alternative specifications of the earnings function [(III-1) and (III-2)] for male employee/professional labour force aged 15 to 60 in Hong Kong yield the following (t ratio in parenthesis):

$$(III\text{-}1) \quad \ln Y = 6.629 + \underset{(252.6)}{0.099\,SCH} + \underset{(140.8)}{0.016\,EXP} + \underset{(23.0)}{0.04\,LOG\,W}$$

$$\bar{R}^2 = 0.256$$

$$(III\text{-}2) \quad \ln Y = 6.532 + \underset{(242.0)}{0.083\,SCH} + \underset{(140.9)}{0.016\,AGE} + \underset{(23.0)}{0.04\,LOG\,W}$$

$$\bar{R}^2 = 0.256$$

Therefore, we can conclude that either of the alternative specifications above would yield the same information regarding the average rates of return to postschool investments.

However, the empirical approximation for experience is, by definition, negatively correlated with the schooling variable[2]. (Velloso 1975:57-59; Carnoy 1979:37) But empirically the observed correlation of schooling and age may be positive or negative depending on the age group under study. (Velloso 1975:58-59) This

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[1] Note that the experience variable is simply measured by age minus the schooling variable minus a constant. Actually, the schooling variable is also statistically holding constant when we estimate the parameter of the experience variable. "Thus, age increments are the same as experience increments, although the latter begin at a later age. When SCH (the schooling variable) is held constant, relative earnings increase due to a one unit increase in Age are the same as those due to a one unit increase in EXP (the experience variable), but the intercept shifts downward." (Velloso 1975:61-62) Therefore, the estimated coefficients of age and experience variables are identical.

[2] This is because experience is simply measured by age minus years of schooling and a constant.

pattern can be clearly borne out by the figures obtained from the Hong Kong data in Table III-3. The negative correlation between experience and schooling is expected to introduce a significant overestimation of the contribution of the schooling component. Again, this can be borne out by the Hong Kong data. Using the earnings inequality function corresponding to the specification of (III-1)[1], we can estimate the direct effect or contribution of the schooling component to the earnings inequality. The estimated effect or contribution of the schooling component to the earnings inequality equals 0.140 points of the explained inequality. However, the total explained inequality obtained from this model is 0.098 points only. The schooling component corresponds to more than 100 percent of the explained inequality. It equals 143 percent of the total explained inequality, which is clearly a large overestimate. This result shows the consequence of the significant collinearity when we use the empirical approximation for the experience variable, i.e., E=(A-S-C). Since the major concern in this study is to examine the effect of the schooling component on the earnings inequality, such an overestimation of the contribution of the schooling component is not permissible. Therefore, the specification of (III-2) is preferable to (III-1) and is used in this study.

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[1] This refers to the following specification of the earnings inequality function:

$$\begin{aligned} Var(\ln Y) = {} & \bar{r}^2 Var(S) + (\bar{r}')^2 Var(E) + \gamma^2 Var(\ln W) \\ & + 2\bar{r}\bar{r}' R_{se} SD(S)\, SD(E) \\ & + 2\bar{r}\gamma R_{sw} SD(S)\, SD(\ln W) \\ & + 2\bar{r}'\gamma R_{ew} SD(E)\, SD(\ln W) \\ & + Var(U) \end{aligned}$$

TABLE III-3

CORRELATION COEFFICIENTS BETWEEN SCHOOLING AND EXPERIENCE OR AGE, MALE EMPLOYEE/PROFESSIONAL LABOUR FORCE AGED 15-60, HONG KONG, 1986[a]

Age Groups	Correlation of Schooling With Experience R_{se}[b]	With Age R_{sa}[b]
15+	-0.55	-0.30
25+	-0.60	-0.31
15-17	-0.92	0.19
18-21	-0.89	0.09
22-24	-0.96	0.01
25-34	-0.79	-0.08
35-44	-0.82	-0.07
45-60	-0.79	-0.23

Source: 1986 Hong Kong By-Census, 1/7 of the population.

Notes :
a. All figures reported are up to two decimal places and are significant at 0.0001 level.
b. For the aggregate set excluding illiterates, R_{se} = - 0.48 and R_{sa} = -0.22.

It is interesting to note that, as Velloso observes, the empirical specification of the earnings inequality function used in the Chiswick and Mincer study (1972) actually corresponds to the specification in (III-2) above. Taking the variance of both sides of (III-2), we obtain

$$\begin{aligned}(\text{III-3}) \quad Var(\ln Y) = {} & (r^*)^2 Var(S) + (r')^2 Var(A) \\ & + \gamma^2 Var(W) + 2 r^* r' R_{sa} SD(S)\, SD(A) \\ & + 2 r^* \gamma R_{sw} SD(S)\, SD(\ln W) \\ & + 2 r' \gamma R_{aw} SD(A)\, SD(\ln W) + Var(U)\end{aligned}$$

where r* and r' are considered as parameters, i.e., as an approximation to the average rate of return to schooling and post-school investments[1].

The specification in (III-2) shows that r* = (r-r'). Thus, substitute r* for r-r', we obtain

$$\begin{aligned}(\text{III-3})' \quad Var(\ln Y) = {} & (r-r')^2 Var(S) + (r')^2 Var(A) \\ & + \gamma^2 Var(\ln W) + 2 (r-r')\, r' R_{sa} SD(S)\, SD(A) \\ & + 2 (r-r')\, \gamma R_{sw} SD(S)\, SD(\ln W) \\ & + 2 r' \gamma R_{aw} SD(A)\, SD(\ln W) + Var(U)\end{aligned}$$

The specification in (III-3)' is exactly the specification used in the Chiswick and Mincer study (1972). [see equation (II-3)]. In other words, both the Velloso study (1975) and the Chiswick and Mincer study (1972) actually used the same specification of the earnings inequality function to analyze the

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[1] According to Chiswick and Mincer (1972 S41-42) and Velloso (1975 Chapter IV) the rates of return to schooling and post-school investments are assumed constant across individuals and also across years of schooling in this study. See also Marin and Psacharopoulos. (1976 pp. 332)

effects of the explanatory variables on the income size distribution. Therefore, using Velloso's model does not deny the validity and inferences of the Chiswick and Mincer model.

It can be observed that using age as a proxy for experience in (III-2) yields a relatively smaller value for the estimated average rate of return to schooling. However, Velloso asserts that since socio-economic background is excluded from the earnings function and since this variable is positively associated with schooling investment, the coefficient of schooling is biased upwards. This tends to offset the underestimation. Thus, it is possible that the specification which introduces age as a proxy for experience yields an adequate value for the rate of return to schooling. (Velloso 1975 : 219)

To sum up, since direct information on experience is not available, we have to use an empirical approximation for experience, that is, E = (A-S-C). However, the empirical approximation for experience introduces a large overestimation of the contribution of the schooling component to the income size distribution when it is used in the earnings inequality function. Therefore, age is viewed as a proxy for experience in this study. In other words, the specifications in (III-2) and (III-3) will be used to test Hypothesis One in this study.

The Variance Form of the Schooling Model

The Model used to test Hypothesis Two in this study is derived from the schooling model postulated by the human capital school.

According to Mincer, the observed earnings of an individual is a function of his earnings-potential originated from investment in schooling and in on-the-job training, i.e.,

(III-4) $Y = f(S, EXP, X_i)$

where Y is the observed earnings, S is the years of schooling (a proxy for the investment in schooling) and EXP is the years of working experience (a proxy for the investment in on the job training). If people do not invest in on-the-job training after completion of schooling, a simple relationship between schooling and earnings can be expressed by the "schooling model" as follows:

(III-5) $\ln Y_s = \ln Y_o + rS$

where Y_s is the potential earnings of an individual with S years of schooling; Y_o is the earnings of an individual with 0 years of schooling; r is the rate of return to schooling; S is the completed years of schooling. (Mincer 1974:11; Liu and Wong 1978:4)

However, a young worker usually accepts lower earnings than

his earnings-potential originated from schooling, if he regards this as a form of investment in on-the-job training and anticipates greater earnings in the future. (Mincer 1974:11; Chung 1990:6) His observed earnings will rise due to the returns to his previous investments in on-the-job training and finally overtake his schooling earnings-potential. It is during this "overtaking" period that his observed earnings equal his potential earnings from schooling. (Mincer 1974:11-18; Chung 1990:6)

During the overtaking period, "observed earnings are what they would have been had zero postschool investments been undertaken". (Addison and Siebert 1979:142) In this period, the effect of schooling on earnings is therefore least masked by the effects of work experience. (Kwok 1984:10) This implies that the explanatory power of schooling in accounting for earnings inequality would be at its maximum in the overtaking experience group. (Mincer 1974:xiv, 11-18; Liu and Wong 1978:5; Addison and Siebert 1979:142) Furthermore, in the regressions of (log) earnings on years of schooling in the overtaking set, "it is likely that experience is better controlled than in regressions where experience and experience squared are simply added, because the rationale of the latter procedure is that all individuals have the same pattern of decline in the investment fraction K_j. In the overtaking experience group, the dispersion in earnings is supposed to be attributable solely to differences in schooling, thereby avoiding the extra 'noise' introduced by different postschool investment patterns." (Addison and Siebert

1979:142) In other words, the overtaking period is "the most appropriate stage" for observing the effects of schooling on the dispersion in earnings which are least contaminated for post-school investment. (Mincer 1976:149) All these account for an alternative attempt to estimate the schooling effect on earnings distribution by applying the schooling model to the overtaking set.

In order to estimate the schooling effects on the distribution of earnings in the overtaking set, equation (III-5), i.e., the schooling model, can be further expressed in a variance form. This can be done by taking the variance of both sides of the equation (III-5). If r in equation (III-5) is regarded as a parameter, i.e., as an approximation to the average rate of return to schooling and r is assumed to be uncorrelated with the level of schooling, we obtain

(III-6) $$Var(\ln Y_s) = \overline{r}^2 Var(S) + Var(U)$$

where Var(U) is the residual variance.(Mincer 1974:60)

Equation (III-6) implies that "relative dispersion of earnings is larger the larger the absolute dispersion in the distribution of schooling and the higher the rate of return." (Mincer 1974:60)

In short, the specifications in (III-5) and (III-6) will be used to test Hypothesis Two in this study.

Data Source and Sample

The source of data is the 1986 By-Census of Hong Kong which covers a one-in-seven sample with about 750,000 records. The sample was selected with the one-phase stratified, replicated and systematic sampling method.

The present study covers only male employees and self-employed professional workers[1], aged 15 to 60, in either the government or the private sectors. Females are excluded because they exhibit a different labour participation pattern. Their potential years of working experience cannot be measured with the Mincer model[2] with the same degree of accuracy as that for males. Earnings reported by employers, unpaid family workers, outworkers and student workers may not be commensurable to their own productivity, so these people are also excluded from the present study. The self-employed professional workers only refer to the self-employed workers who are classified as professional, technical and related workers in the By-Census. Younger persons below 15 years old are excluded because the compulsory education prohibit them from joining the labour forces and they are considered economically inactive. Older persons above 60 years old are excluded because many have low labour force participation due to ill health and discrimination and these variables often

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[1] The sample used in Mincer's empirical analyses was males with some earnings and earnings were defined as wages and salaries plus self-employment income. (Mincer 1974:44) Velloso's study also included employees and self-employed professional workers since such a sample "should provide a satisfactory approximation for the desired variable, income from labour." (Velloso 1975:44)

[2] According to Mincer's schooling model, the potential year of experience of an individual can be approximated by the following formulation : Experience = Age - Total Years of Schooling - Age in Starting Formal Schooling (e.g. 6).

affect their labour supply. Exclusion of persons over 60 also reduces the usually observed negative simple correlation between age (or experience) at older ages, thus yielding a more appropriate estimate of the average rate of return to experience. (Velloso 1975:43-44)

Measurement of Variables

Earnings refer to the pre-taxed monthly income. They are income from the main employment in February reported to the Hong kong By-Census of 1986.

Schooling is quantified as the number of years of schooling received by an individual. The years of schooling of the individuals, however, are not reported directly. They have to be inferred from the level of education attainment reported by the individual. The level of education contains 20 categories in 1986[1].

In order to verify Hypothesis Two in this study, the aggregate sample has to be divided into different groups by experience. Empirically the experience is simply measured as age minus years of schooling minus age at the beginning of formal schooling. (Mincer 1974:84) Since most children in Hong Kong enter primary school at six years old, the age in starting formal schooling is usually defined as the age of six. This measure of work experience is widely used because it is considered without

[1] For details, see Appendix II.

much error particularly when it applies to male workers. Labour force experience of men is unlikely to be discontinuous. More essentially, it seems that no other alternative is available, especially when the study involves a large number of people. However, it should be noted that there is a number of factors which affect the value of the approximation for years of experience in the labour force. Late entrance in schooling, repetition and different length of elementary schooling are some of these factors. (Velloso 1975:51)

The available information which can be used as a measure of the employment variable is the total hours worked in the week preceding the census date.

CHAPTER IV

SCHOOLING AND THE DISTRIBUTION OF EARNINGS IN HONG KONG

In this chapter the effects of the explanatory variables on the distribution of earnings are analyzed in both the aggregate and overtaking sets. The analysis is undertaken in cross section and within a human capital framework. The major concern in the present study is to estimate the contribution of schooling toward the observed distribution of earnings in the aggregate and overtaking sets in Hong Kong in 1986. The contribution of schooling toward the earnings inequality is estimated so as to verify the two hypotheses formulated in Chapter III. The contribution of schooling toward the earnings inequality is also estimated for the aggregate set excluding illiterates. Observations on age groups are presented in the final section.

The Aggregate Set

Hypothesis One formulated in Chapter III suggests that there is a significant effect of schooling on the distribution of earnings in the aggregate set. Therefore, in this section, the earnings inequality function [equation(III-3)] is applied to the aggregate set to verify this hypothesis. The population under study is the male employees and male self-employed professional workers aged 15-60 in Hong Kong in 1986.

The effects of the explanatory variables on the distribution of earnings can be analyzed using the earnings inequality

function [equation (III-3)], where we insert the relevant estimates for the coefficients of schooling, age and employment as well as for the correlations, variances and standard deviations of these variables. The coefficients of schooling, age and employment are obtained through ordinary least squares of the parameters of the earnings function [equation (III-2)]. Coefficients of the explanatory variables yielded by ordinary least squares are as follows: (t ratios in parenthesis):

$$\text{(IV-1)}\quad \text{LOG Y} = 6.532 + \underset{(242.0)}{0.083}\ \text{SCH} + \underset{(140.9)}{0.016}\ \text{AGE} + \underset{(23.0)}{0.040}\ \text{LOG W}$$

R^2 = 0.256

LOG Y = log of earnings

SCH = schooling

LOG W = employment (log of time worked)

N = number of observations

= 186,652[1]

The estimates for the earnings inequality function for the aggregate distribution of earnings are presented in Table IV-1 below. The absolute size of the contributions of schooling, age and employment as well as the joint contributions of these variables towards relative earnings inequality are displayed in the second column. The relative contributions of these components toward the observed relative earnings inequality are reported in the adjacent column.

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[1] The source of data is the Hong Kong By-Census in 1986, which covers 1/7 of the population in 1986.

TABLE IV-1
CONTRIBUTIONS OF SCHOOLING, AGE AND EMPLOYMENT TOWARD EARNINGS INEQUALITY, MALE EMPLOYEE/SELF-EMPLOYED PROFESSIONAL LABOUR FORCE AGED 15-60, HONG KONG, 1986[a]

Component[b]	Effects	Relative Effects on Observed Inequality (%)
(S)	0.0975	25.54
(A)	0.0331	8.67
(W)	0.0008	0.21
(S,A)	-0.0332	-8.70
(S,W)	-0.0004	-0.10
(A,W)[c]	0	0
Explained Inequality Var(lnY)*	= 0.0977	
Residual Inequality Var(U)	= 0.2841	74.41
Observed Inequality Var(lnY)	= 0.3818	100.00
R^2 [d] = Var(lnY)*/Var(lnY)	= 0.2558	

Source: 1986 Hong Kong By-Census, 1/7 of the population.

Standard deviations and correlations of variables are reported in Appendix III Table A. III-1.

Notes :

a. Totals may not add up due to rounding.

b. Components are defined as follows: (S) = schooling; (A) = age; (W) = employment; (U) = unexplained component; i.e., the residual factors. Joint components are: (S,A) = schooling and age; (S,W) = schooling and employment; (A,W) = age and employment.

c. (A,W) = -0.000008 ≈ 0 since the figures reported are up to four decimal places, for example, (W) = 0.00081 ≈ 0.0008. The effect of the joint component (A,W) is so small because the zero-order correlation coefficient of age and employment is very small (R_{aw} = -0.00084).

d. R^2 = coefficient of determination.

The total number of observations in the aggregate set is 186,652. The findings displayed in Table IV-1 show that the variance of log earnings explained by the model is $Var(lnY)^* = 0.0977$ and the observed earnings inequality is $Var(lnY) = 0.3818$. Thus the explanatory power of the model can be obtained, that is, $R^2 = 0.0977:0.3818 = 0.256$, which is the coefficient of determination previously reported. It should be noted that, given the large number of cases, $\bar{R}^2$ [1] $= R^2$ (up to four decimal places). This is also true for the other estimates reported in this study.

The findings also show that the schooling component alone accounts for about one fourth(25.54%) of the observed variance of log earnings. However, the distribution of age component is only responsible for 8.67% of the observed earnings inequality. The relative distribution of employment has quite a small effect(0.21%) on the observed inequality of earnings. These results, therefore, substantiate the hypothesis of a significant contribution of schooling toward the distribution of earnings in the aggregate set. In other words, Hypothesis One is substantiated.

The findings displayed in Table IV-1 are consistent with the results of the study by Velloso (1975 Chapter III and IV) on the distribution of earnings for the male literate employee/self-employed labour force in Brazil, a developing country in South America. Both studies find that the schooling component is significantly responsible for the observed relative variance of

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[1] $\bar{R}$ is the coefficient of determination corrected for degrees of freedom.

earnings and the contribution of the employment component to the inequality is quite small when compared to that of schooling and age.

A preliminary test of the effects of the explanatory variables (i.e., schooling, age and employment) on individual earnings is obtained from the partial slopes yielded by the regression equation [equation (IV-1)] for the male employees and male self-employed professional workers[1]. The results show that all coefficients of the explanatory variable are positive and significantly different from zero at the 0.0001 level [see estimates in equation (IV-1)]. These results substantiate the human capital hypothesis of a positive and significant effect of schooling and post-school investments as well as of employment on individual earnings[2]. This implies that in the aggregate, other things being constant, an individual with more schooling or post-school investments earns more. Under a similar **ceteris paribus** assumption, an individual will earn more if he works more hours or weeks.

Since the findings show that schooling is significantly and positively related to individual earnings, other things being equal, the income gaps between individuals of the labour force will be narrowed when the differences in education attainments of the individuals are reduced. For the same reason, other things being equal, the income gaps between individuals of the labour force will be widened when the differences in educational

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[1] This preliminary test was also undertaken in Velloso's study. (Velloso 1975:70)

[2] These results are consistent with the findings of the studies for the U.S. (Mincer 1974; Chiswick and Mincer 1972), Brazil (Velloso 1975) and Hong Kong (Kwok 1984).

attainments of the individuals increase. Therefore, the substantiation of the human capital hypothesis of a positive and significant effect of schooling on individual earnings implies that in the aggregate, other things being constant, as the variance of schooling in the labour force increases, so does the relative inequality of earnings. It also implies that in the aggregate, other things being constant, the relative inequality of earnings decreases when the variance of schooling decreases. Under a similar **ceteris paribus** assumption the aggregate results indicate that the same inference is valid for the distribution of post-school investments - approximated by the distribution of age - and for the relative distribution of employment.[1]

These implications are consistent with findings of studies across the states in the U.S. (Becker and Chiswick 1966:358-369; Chiswick 1974: part B, chs. 3,4), in a Brazilian male literate labour force (Velloso 1975:67-70), a Mexican sample of male workers and in the Puerto Rican male labour force (Chiswick 1974 : part B, chs. 3,4). In their studies for a large number of developed and developing countries, Lydall (1968:209-14) and Psacharopoulos (1978:50) both found that inequality in schooling is positively related to inequality in earnings.

The earnings inequality function also indicates that the higher the average rate of return to schooling investments, other things being constant, the larger the inequality of earnings. In other words, for the same distribution of schooling investments, as the average payoff to these investments rises,

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[1] Similar inferences can be found in Velloso's work. (Velloso 1975:70)

the distribution of income becomes even more unequal. This implication is conceivable because, other things being constant, a rise in the average rate of return leads to a greater increase in the earnings of those with more years of schooling. This widens the income gaps among individuals with different levels of schooling and, therefore, increases earnings inequality[1].

We now turn to an analysis of the joint contributions of the components. According to Chiswick and Mincer, the joint contributions of the components have economic meaning. (Chiswick and Mincer 1972:S40-41)

Secular trends in schooling are expected to be operative in developing countries. (Liu and Wong 1978:11-15) It is commonly believed that upward secular trends in schooling will produce a negative correlation between schooling and age. (Chiswick and Mincer 1972:S40)

The findings of the present study show that the joint contribution of schooling and age is negative in the aggregate sample[2]. [See (S,A) in Table IV-1] Thus, the results obtained are consistent with what is expected[3].

A negative correlation between schooling and age, which reflects a secular trend in schooling, implies "that average age is older in the lower schooling groups, younger in the higher

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1 Velloso has made similar observations. (Velloso 1975:70-71)

2 The joint contribution of schooling and experience is also negative in the aggregate population. The value of R_{se} is -0.55.

3 The correlation coefficient between schooling and age, for example, is also negative even for the data for the U.S., a developed country. (Chiswick and Mincer 1972 S40,S64)

schooling groups". (Mincer 1974:45) As is well known, among workers with the same level of schooling, older workers tend to have higher earnings due to their relatively large experience. (Mincer 1974:45) But if one considers schooling investments alone, earnings of younger workers will be higher since younger workers tend to have a higher level of schooling because of the secular trends in schooling. If one considers both schooling investments and work experience, younger workers tend to be more educated but less experienced. In other words, the schooling effect tends to be offset by the experience effect[1]. This also applies to the older workers since older workers tend to be less educated but more experienced. A negative correlation thus tends to narrow older-younger earnings differentials. This implies that when the secular trend in schooling increases, that is, when the correlation between age and schooling becomes more negative, inequality of earnings decreases. (Chiswick and Mincer 1972:S40)

For the sample in the present study, the correlation between age and schooling is negative and strong ($R_{sa} = -0.3$) because the effects of upward secular trends in schooling have been quite large and only a small part of them is offset by the positive correlation between schooling and age among very young workers. For illustration, the estimates of the correlation coefficients between schooling and age and the mean years of schooling within age groups of the aggregate set are presented in Table IV-2[2].

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[1] The young whose few prior but relatively large contemporaneous investments would tend to lower their net earnings, also have greater than average schooling, which tends to raise their earnings. (Chiswick and Mincer 1972:S40).

[2] The aggregate population is divided into the age groups as in Table III-1 presented in Velloso's study. Unlike Brazilian data used in Velloso' study, where persons aged 14 are included in the employed labour force, the census data for Hong Kong in 1986 covers persons aged 15 and above only. See Table III-1 in Velloso's dissertation. (Velloso 1975:58)

TABLE IV-2
AVERAGE YEARS OF SCHOOLING AND CORRELATION COEFFICIENTS BETWEEN SCHOOLING AND AGE WITHIN AGE GROUPS OF THE AGGREGATE SET, MALE EMPLOYEE/SELF-EMPLOYED PROFESSIONAL LABOUR FORCE AGED 15-60, HONG KONG, 1986[a]

Age Groups	R_{sa} [b]	$\bar{S}$ [c]
15-60	-0.30	8.68
25-60	-0.31	8.44
15-17	0.19	8.36
18-21	0.09	9.46
22-24	0.01	9.75
25-34	-0.08	9.39
35-44	-0.07	8.62
45-60	-0.23	6.68

Source: 1986 Hong Kong By-Census, 1/7 of the population.

Notes :
a. All figures reported are up to two decimal places.

b. R_{sa} = correlation coefficient between schooling and age. All correlation coefficients are significant at the 0.0001 level.

c. $\bar{S}$ = mean years of schooling.

In Table IV-2, we can observe that the correlation coefficients between schooling and age are all positive for the young workers aged 15 to 24. We can also observe that the correlation coefficients between schooling and age are all negative for the older workers aged above 24. This pattern is consistent with the findings of Velloso's study. (Velloso 1975:58) The negative correlations between age and schooling for the older groups shown in Table IV-2, however, are comparatively stronger than the positive correlations between age and schooling for the younger groups. This contributes to an overall negative correlation between schooling and age for the aggregate set which includes workers aged 15 to 60. We can also observe that the negative correlation for the group aged above fifteen is only slightly lower than the group aged above twenty-five. This suggests that the inclusion of the younger groups aged 15 to 24, where schooling and age are positively correlated, may offset only a small part of the negative correlation between schooling and age for the overall sample.

The strong negative correlations between schooling and age, as noted above, are regarded as the result of upward secular trends in schooling. The mean years of schooling within different age groups presented in Table IV-2 indicate that the average level of schooling is higher in the younger groups but lower in the older groups. In other words, this reflects an upward secular trend in schooling. This trend is more distinguishable if we divide the sample into age groups as in Table IV-3 below:

TABLE IV-3
AVERAGE YEARS OF SCHOOLING WITHIN AGE GROUPS OF THE AGGREGATE SET, MALE EMPLOYEE/SELF-EMPLOYED PROFESSIONAL LABOUR FORCE AGED 15-60, HONG KONG, 1986[a]

Age Groups	Average Years of Schooling
15-20	9.14
21-25	9.74
26-30	9.52
31-35	9.04
36-40	8.26
41-45	8.17
46-50	7.66
51-55	6.20
56-60	5.37

Source : 1986 Hong Kong By-Census, 1/7 of the population.

Notes : a. All figures reported are up to two decimal places.

The observed secular trends in schooling are probably caused by rapid education expansion initiated by the Hong Kong government in the past decades, as mentioned in Chapter III. Liu and Wong have made similar observations in their study for Singapore. (Liu and Wong 1978:11-25) As is well known, Singapore is also a rapidly developing LDC. Liu and Wong observe that "in a rapidly developing country like Singapore in which expansion and modernization of the education system is pervasive, most individuals with less schooling tend to belong to an earlier cohort". (Liu and Wong 1978:23-25) This observation also applies to Hong Kong.

The joint contribution of schooling and log of time worked is negative but small in the aggregate sample in this study. (See Table IV-1) This is due to the negative correlation between schooling and log of time worked. This result is consistent with the findings of Velloso's study for Brazil (Velloso 1975:69, 293). The findings of a study for Hong Kong also show that there is a negative correlation between schooling and log of time worked. (Kwok 1984:11-13) Further evidence for this phenomenon is presented in Table IV-4 which gives the averages and standard deviations of the number of hours worked per week for different schooling groups. Results presented in Table IV-4 are consistent with those reported in Kwok's study (Kwok 1984:13 Table 3.4).

TABLE IV-4
SCHOOLING AND AVERAGE WORKING HOURS,
MALE EMPLOYEE/SELF-EMPLOYED PROFESSIONAL LABOUR FORCE AGED 15-60,
HONG KONG, 1986[a]

Years of Schooling	Number of Hours Worked	
	Mean	Standard Deviation
0[b]	51.58	18.69
1-3	52.40	17.07
4-6	52.72	15.09
7-9	51.95	14.20
10-11	49.17	12.73
12-15	45.53	11.37
16 & Over	45.56	12.25

Source : 1986 Hong Kong By-Census, 1/7 of the population.

Notes : a. All figures are reported up to two decimal places. The total number of the observations is 186,652.

b. Those with kindergarten schooling are also regarded as persons with zero schooling.

The joint contribution of age and log of time worked for the aggregate sample in this study is also negative but very small. (See Table IV-1) Again, this result is consistent with the findings of Velloso's study. (Velloso 1975:69) Further evidence for the very small correlation between age and log of time worked is presented in Table IV-5 where the averages and the standard deviations of the number of hours worked per week for different age groups are almost the same.

According to Chiswick and Mincer, nonzero correlation of time worked with schooling and age, respectively, can be explained by both supply of labour and demand for labour factors. On the demand side, increased investments in specific training with higher levels of schooling and age, until older ages, diminish the firm's incentive to lay off such workers, and thereby increase the stability of employment. On the supply side, investments specific to the firm (for example, training and nonvested pension funds) also increase with schooling and age, again until older ages, thereby lower quit rates. However, Chiswick and Mincer also observed that there were lower levels of time worked by the young. This may be due to the higher turnover rate of younger workers who search for information about the nature of jobs. (Chiswick and Mincer 1972:S40-S41) The younger workers, who have lower levels of time worked, also tend to have a higher level of schooling because of the secular trends. This may imply a negative correlation between schooling and log of time worked, particularly in a developing country like Hong Kong where secular trends are strong.

TABLE IV-5
AGE AND AVERAGE WORKING HOURS,
THE AGGREGATE SET,
MALE EMPLOYEE/SELF-EMPLOYED PROFESSIONAL LABOUR FORCE AGED 15-60,
HONG KONG, 1986[a]

Age Groups	Number of Hours Worked	
	Mean	Standard Deviation
15-20	49.54	13.79
21-25	49.28	13.17
26-30	49.88	13.70
31-35	50.51	14.16
36-40	51.06	14.48
41-45	51.68	15.05
46-50	51.15	15.28
51-55	51.16	15.98
56-60	51.30	16.68
N[b]	186,652	

Source : 1986 Hong Kong By-Census, 1/7 of the population.

Notes : a. All figures reported are up to two decimal places.

b. N = total number of the observations.

Furthermore, as mentioned in Chapter III, there is a persisting low unemployment rate in Hong Kong. This reflects that employment opportunities for the less educated workers in Hong Kong are also plentiful and, thus, a worker may not be less stable in employment only because he is less educated. Therefore, the positive effect of the schooling level on the stability of employment may be insignificant. The less educated workers, in addition, may have the incentive to work more weeks or hours[1] to improve their levels of earnings since they tend to belong to, according to a human capital prediction, the low income groups. On the other hand, workers with higher levels of schooling tend to have more paid leaves or holidays. Besides, the obsolescence of human capital investments or ill health are conducive to higher unemployment (on the demand side) and/or a smaller supply of worker (on the supply side) among older workers (Velloso 1975:98). All these factors suggest that there may be negative correlations of time worked with schooling and age, respectively. Nevertheless, for the Hong Kong data in 1986, the correlations of log of time worked with schooling and age are small and the results may be suggestive rather than conclusive.

To sum up, the direct effect of the schooling component accounts for about 26 per cent of the observed distribution

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[1] In Hong Kong, it is common for a worker to have more than one job or to do overtime work.

of earnings in the aggregate sample. The hypothesis of a significant contribution of schooling toward the aggregate distribution of earnings is therefore substantiated. The results also substantiate the human capital hypothesis of a positive and significant effect of schooling on individual earnings. A substantial negative correlation between schooling and age is also observed in the aggregate set. These indicate that most individuals with less schooling belong to an older cohort.

The Aggregate Set Excluding Illiterates

Samples used in previous studies of inequality of earnings within a human capital framework always include illiterates or persons with zero schooling[1]. In the previous section, the sample under study also includes illiterates. Velloso suggested that, however, the human capital model for the size distribution of earnings was conceived to study earnings inequality of individuals who had some investments in training. Therefore, he excluded persons with zero schooling from the sample in his study. In this section, the aggregate set excluding persons with zero schooling is also used to verify Hypothesis One. The coefficients of the explanatory variables (i.e., schooling, age and employment)

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[1] See Marin Psacharopoulos (1976 pp.332); Chiswick & Mincer (1972 S41); Mincer (1974 pp.44, 48 & 66-73) and Tilak (1989 pp.73, 106-110). Those with kindergarten schooling are also regarded as persons with zero schooling in the present study.

are obtained through ordinary least squares of the parameters of the earnings function [equation (III-2)]. The results are as follows (t ratios in parenthesis):

(IV-2) $$\text{LOG } Y = 6.471 + \underset{(234.1)}{0.089}\ \text{SCH} + \underset{(138.9)}{0.016}\ \text{AGE} + \underset{(21.2)}{0.038}\ \text{LOG } W$$

$R^2 = 0.260$

$N = 179,118$[1]

[The variables are as defined in the regression equation (IV-1); N = the total number of observations]

The estimates for the earnings inequality function [equation (III-3)] for this sample are presented in Table IV-6 below.

[1] The source of data is the Hong Kong By-Census in 1986, which covers 1/7 of the population in 1986.

TABLE IV-6
CONTRIBUTIONS OF SCHOOLING, AGE AND EMPLOYMENT TOWARD EARNINGS INEQUALITY, MALE LITERATE EMPLOYEE/SELF-EMPLOYED PROFESSIONAL LABOUR FORCE AGED 15-60, HONG KONG, 1986[a]

Component[b]	Effects	Relative Effects on Observed Inequality (%)
(S)	0.0913	23.89
(A)	0.0320	8.37
(W)	0.0007	0.18
(S,A)	-0.0242	-6.33
(S,W)	-0.0006	-0.15
(A,W)[c]	0	0
Explained Inequality = Var(ln Y)*	0.0992	
Residual Inequality = Var(U)	0.2830	74.05
Observed Inequality = Var(ln Y)	0.3822	100.00
R^2 = Var(ln Y)*/Var(ln Y) = 0.2596		

Source: 1986 Hong Kong By-Census, 1/7 of the population.

Standard deviations and correlations of variables are reported in Appendix III Table A. III-1.

Notes :

a. Totals may not add up due to rounding.

b. Components are as defined in Table IV-1.

c. (A,W) = +0.000008 = 0 since the figures reported are up to four decimal places. The effect of the joint component (A,W) is so small because the zero-order correlation coefficient of age and employment is very small (R_{aw} = +0.00081).

The total number of observations in the aggregate set excluding illiterates is 179,118. Table IV-6 shows that the variance of log earnings explained by the model is Var(ln Y)* = 0.0992 and the observed earnings inequality is Var(ln Y) = 0.3818. Thus, the explanatory power of the model can be obtained, that is, R^2 = 0.0992:0.3822 = 0.260, which is the coefficient of determination previously reported. [see equation (IV-2)]

The findings also show that the schooling component alone accounts for about one fourth (23.89%) of the observed variance of log earnings. However, the distribution of age component is only responsible for 8.37% of the observed earnings inequality. The relative distribution of employment has a quite small effect (0.18%) on the observed inequality of earnings. These results, therefore, substantiate the hypothesis of a significant contribution of schooling toward the distribution of earnings in the aggregate set excluding illiterates. In other words, Hypothesis One is substantiated even if the aggregate set excludes illiterates.

The findings displayed in Table IV-6 are consistent with those displayed in Table IV-1. However, it is interesting to note that if illiterates are excluded from the aggregate set, the correlation of age and schooling (R_{sa} = -0.22) becomes less negative as compared with the aggregate set including illiterates. (For the aggregate set, R_{sa} = -0.3) This is because most of the illiterates are very old workers. Exclusion of these workers therefore lowers the negative correlation between age and

schooling in the aggregate set. However, it should be noted that the correlation of age and schooling still holds a negative value. This indicates that even the illiterates are excluded, most individuals with less schooling still tend to belong to an older cohort.

A preliminary test of the effects of the explanatory variables on individual earnings is also obtained from the partial slopes yielded by the regression equation [equation (IV-2)] for the aggregate sample excluding illiterates. The results show that all coefficients of the explanatory variables are positive and significantly different from zero at the 0.0001 level [see estimates in equation (IV-2)] These results substantiate the human capital hypothesis of a positive and significant effect of schooling and post-school investments as well as of employment on individual earnings. Again, as mentioned in the previous section, these results imply that in the aggregate, other things being constant, as the variance of schooling in the labour forces increases, so does the relative inequality of earnings. Under a similar **ceteris paribus** assumption, the aggregate results indicate that the same inference is valid for the distribution of post-school investments - approximated by the distribution of age - and for the relative distribution of employment.

To sum up, the direct effect of the schooling component accounts for about 24 per cent of the observed distribution of earnings in the aggregate set excluding illiterates. Thus, no

matter whether the aggregate sample under study includes persons with zero schooling or not, the hypothesis of a significant contribution of schooling toward the aggregate distribution of earnings is substantiated. The results also verify the human capital hypothesis of a positive and significant effect of schooling on individual earnings.

The Overtaking Set

As mentioned in Chapter III, the overtaking period is regarded as the most appropriate stage for observing the effects of schooling on the dispersion in earnings which are least contaminated for post-school investment. This accounts for an alternative attempt to estimate the schooling effect on earnings distribution in the "overtaking set".

Hypothesis Two formulated in Chapter III suggests that there is a significant effect of schooling on the distribution of earnings in the overtaking set. In this section, the variance form of the schooling model [equation (III-6)] is therefore applied to the overtaking set to verify this hypothesis. The sample under study is the male employee/self-employed professional labour force aged 15-60 in Hong Kong.

The schooling model equation [equation (III-5)] is run for different experience groups as presented in Table IV-7. The coefficient of determination is highest for the 8-11 years of experience group. This gives an indication of the period during

which the effect of schooling on earnings is least masked by the effects of work experience. In other words, this gives a rough estimate of the overtaking period of experience[1]. (Mincer 1974:57; Kwok 1984:11)

By running regressions in several alternative subsets of the sample, representing approximations to the overtaking stage of experience, it can be observed from Table IV-8 that the coefficient of determination (R^2) and the regression slope differ somewhat depending on which interval of experience is chosen. The R^2 in these regressions ranged from 0.408 to 0.460 while the slopes of the schooling variable, which are estimates of the average rate of return, vary between 0.136 and 0.140. When compared with the regression results for the entire sample, both the coefficient of determination and the rate of return to schooling are larger in these subsets. The inclusion of the logarithm of hours worked raises marginally the partial coefficients for the schooling variable. Again, this indicates that (logs of) hours worked per week are negatively (but slightly) correlated with schooling, as it is observed in the aggregate sample. (See also Kwok 1984 p.11) Among these subsets, the coefficient of determination is highest for the group with 8 to 10 years of experience. Thus, the overtaking set is defined as the experience group with 8 to 10 years of experience in this study.

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[1] Even if we use the alternative specification of the schooling model, i.e.

$$\ln Y = \alpha + b_1 S + b_2 S^2$$

or the model where log of hours worked is included as a standardizing variable, i.e.

$$\ln Y = \alpha + rS + \ln W$$

the overtaking period is the same. (See Appendix III Table A.III-2)

TABLE IV-7
SCHOOLING REGRESSIONS WITHIN EXPERIENCE GROUPS, MALE EMPLOYEE/SELF-EMPLOYED PROFESSIONAL LABOUR FORCE AGED 15-60, HONG KONG, 1986[a]

Years of Experience	R^2 [b]
Below 4	0.355
4-7	0.404
8-11	0.417
12-15	0.410
16-19	0.333
20-23	0.244
24-27	0.191
28-31	0.177
32-35	0.170
36-39	0.121
40-43	0.042
44-47	0.011
Over 47	0.003

Source : 1986 Hong Kong By-Census, 1/7 of the population.

Notes :

a. The figures reported are up to three decimal places.

b. R^2 = coefficient of determination of regression equation: $\ln Y = \alpha + rS$

where Y = earnings of male employees and self-employed professional labour force in the calendar month before the By-Census in 1986; α = intercept; r = average rate of return to schooling; S = years of schooling.

TABLE IV-8
REGRESSIONS IN OVERTAKING SETS,
MALE EMPLOYEE/SELF-EMPLOYED PROFESSIONAL LABOUR FORCE
AGED 15-60,
HONG KONG, 1986[a]

Years of Experience	Number of Observations		Regression Coefficients Intercept	S^b	S^2	Log W^c	R^2 [d]
7-11	32,687	(1)	6.629	0.136			0.409
			(683.2)	(150.3)			
		(2)	6.467	0.137		0.030	0.410
			(285.1)	(150.7)		(7.9)	
7-9	19,820	(1)	6.535	0.140			0.415
			(510.4)	(118.6)			
		(2)	6.352	0.140		0.034	0.417
			(217.0)	(119.0)		(6.9)	
9	6,483	(1)	6.635	0.137			0.408
			(304.4)	(66.8)			
		(2)	6.426	0.137		0.039	0.410
			(127.54)	(67.1)		(4.6)	
8-11	26,123	(1)	6.654	0.137			0.417
			(626.1)	(136.7)			
		(2)	6.507	0.137		0.027	0.418
			(260.5)	(136.9)		(6.5)	
8-10	19,771	(1)	6.602	0.140			0.422
			(531.3)	(120.1)			
		(2)	7.674	-0.076	0.010		0.459
			(244.2)	(-12.8)	(36.9)		
		(3)	6.474	0.140		0.024	0.422
			(222.8)	(120.2)		(4.9)	
		(4)	7.511	-0.078	0.010	0.032	0.460
			(189.9)	(-13.1)	(37.2)	(6.8)	

Source : 1986 Hong Kong By-Census, 1/7 of the population.

Note : a. Figures in parentheses are t ratios. All figures are reported up to three decimal places.

b. S = years of schooling.

c. W = total hours worked.

d. R^2 = coefficient of determination.

Having determined the overtaking year of experience, the schooling model in variance form [equation (III-6)] can be fitted to individuals in this group to establish the true effect of schooling on the dispersion of earnings[1]. The results estimated in the overtaking set with 8-10 years of experience are reported in Table IV-9.

The total number of observations in the overtaking set is 19,771. The coefficient of the schooling variable, i.e., the estimate of the rate of return to schooling, is positive and significantly different from zero at the 0.0001 level. This substantiates the human capital hypothesis of a positive and significant effect of schooling on individual earnings in the overtaking set.

Table IV-9 shows that the estimated average rate of return to schooling in the overtaking set is 0.14. The variance of schooling in the overtaking set is 7.501. The variance of log earnings explained by the model is $r^2Var(S)=0.147$ and the observed earnings inequality in the overtaking set is 0.346. Thus, the explanatory power of the model can be obtained, that is, $R^2=0.147:0.346=0.422$, which is the coefficient of determination previously reported in Table IV-8.

The findings displayed in Table IV-9 show that the schooling component accounts for about 42 per cent of the dispersion of log earnings in the overtaking set. Thus, the hypothesis of a significant contribution of schooling to the distribution of earnings in the overtaking set is substantiated. In other words, Hypothesis Two is substantiated.

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[1] See Liu and Wong (1978 pp.6)

TABLE IV-9
CONTRIBUTIONS OF SCHOOLING TOWARD EARNINGS INEQUALITY IN OVERTAKING SET, MALE EMPLOYEE/SELF-EMPLOYED PROFESSIONAL LABOUR FORCE AGED 15-60, HONG KONG, 1986[a]

	Overtaking Set
r[b]	0.140 (120.061)
Var(S)[c]	7.501
Effect[d]	0.147
Var(lnY)[e]	0.346
Relative Contribution to Var(lnY)[f]	42%
R^2 [g]	0.422
Residual Variance	0.199
N[h]	19,771

Source : 1986 Hong Kong By-Census, 1/7 of the population.

Note : a. Figures in parentheses are t ratios. All figures reported are up to three decimal places.

b. r = rate of return to schooling.

c. Var(S) = Variance of years of schooling.

d. Effect = $\overline{r}^2$ Var(S).

e. Var(lnY) = Variance of logarithms of earnings of male employee/self-employed professional labour force.

f. Relative contribution to

$$Var(\ln Y) = \frac{\overline{r}^2 Var(S)}{Var(\ln Y)}.$$

g. R^2 = coefficient of determination.

h. N = total number of observations.

The schooling model in variance form [equation (III-6)] predicts that, if variations in the discount rate are ignored, the greater the variance in years of schooling becomes, the larger would be the variance of the log earnings[1]. It is interesting to note that figures given in Table IV-10 for various experience groups indicate this pattern.[2]

Figures given in Table IV-10 may indicate that the rapid education expansion initiated by the government has successfully raised the average level of schooling in the less experienced or younger cohorts[3] with less than 12 years of experience. (Table IV-2 and IV-3 also indicate that average level of schooling is higher in the younger groups but lower in the older groups). For workers with less than 4 years of experience, for example, the average level of education attainments is about 11 years of schooling. This level is quite high as compared with the experience group with more than 47 years of experience, within which the workers have an average of less than two years of schooling. Thus, the difference in education attainments between the most experienced group and the least experienced group is quite large. This reflects the problem that though education expansion raises the average level of schooling within the less experienced or younger cohorts, the older workers are precluded from enjoying the benefits of education expansion, and, thus a substantial inequality in schooling occurs between the experience groups.

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[1] See Mincer (1974:60); Liu and Wong (1978:6).

[2] This pattern can be observed by comparison between the experience groups with similar rates of return to schooling.

[3] Less experienced workers in general tend to belong to younger cohorts.

TABLE IV-10
AVERAGE YEARS OF SCHOOLING, VARIANCES OF SCHOOLING AND VARIANCES OF LOG OF EARNINGS, BY EXPERIENCE GROUPS, MALE EMPLOYEE/SELF-EMPLOYED PROFESSIONAL LABOUR FORCE AGED 15-60, HONG KONG, 1986[a]

Years of Experience	Var(lnY)	Var(S)	r	$\bar{S}$[c]	N[d]
below 4	0.275	5.254	0.136	11.276	11536
4-7	0.302	6.085	0.142	10.940	24322
8-11[b]	0.350	7.753	0.137	10.219	26123
12-15	0.413	9.362	0.134	9.419	23899
16-19	0.411	10.286	0.115	8.843	21448
20-23	0.377	11.512	0.089	8.322	18347
24-27	0.409	14.887	0.072	8.163	13867
28-31	0.398	15.879	0.067	7.951	10451
32-35	0.393	14.547	0.068	7.393	8864
36-39	0.340	12.147	0.058	6.416	8291
40-43	0.254	9.294	0.034	5.195	7998
44-47	0.215	6.303	0.019	3.695	6525
over 47	0.211	3.804	0.012	1.831	4981
Aggregate Set	0.382	14.156	0.083	8.681	186652

Source : 1986 the Hong Kong By-Census, 1/7 of the population.

Note :
a. All figures reported are up to three decimal places. Variables are as defined in previous tables.

b. The experience groups under 12 years of work experience are viewed as less experienced groups.

c. $\bar{S}$ = mean years of schooling.

d. N = total number of observations.

Figures given in Table IV-10 may also indicate that the more rapid expansion of primary and lower secondary schooling when compared with the expansion of upper levels has brought about a reduction in inequality of schooling in the younger cohorts. For the cohort with less than 4 years of experience, for instance, the variance of schooling is only 5.254. As expected, this is much lower than that of the aggregate set. (For the aggregate set, the variance of schooling is 14.156.) It is interesting to note that the variances of schooling are also low for the very experienced workers who are believed to be precluded from enjoying the benefits of education expansion. This is because most of the workers included in the very experienced cohorts are poorly educated or even illiterate.

The present study defines 8 to 10 years of experience as the overtaking period in Hong Kong[1]. This is consistent with the inference drawn by Mincer that the overtaking year of experience should be a decade or less. (Mincer 1974:49) The result is also similar to the findings of a study by Liu and Wong for Singapore, where the overtaking set is defined as the experience group with 7 to 9 years of experience. (Liu and Wong 1978:9) Like Hong Kong,

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[1] Using a sample with 896 observations, Kwok defined the overtaking set as the experience group with 4 to 6 years of experience for the Chinese men in Hong Kong in 1976. (Kwok 1984:10) Liu and Wong, however, defined the overtaking set as the experience group with 10 to 13 years of experience in a study for Hong Kong in 1978. (Liu and Wong 1978:28,31) In the present study, the overtaking period is defined as 8 to 10 years of experience. This ranks between the intervals of experience (4 to 6 years and 10 to 13) which are approximated as the overtaking periods in the two studies quoted above. It is conceivable that the findings about the overtaking period are different in these studies because they refer to different data sets obtained in different years. The sample used in Kwok's study, for example, covered only 896 observations obtained from 1/100 sample of the Hong Kong By-Census in 1976. The sample used in the present study, however, covers 19,771 observations obtained from the Hong Kong By-Census in 1986. In addition, the sample used in the present study is clearly defined as the male labour force restricted to employees and self-employed professional workers only. As compared with Kwok's findings, the results of the present study may indicate that the workers in 1986 enjoyed a smaller rate of return to post-school investments, therefore they had to take a longer period of time to overtake their potential earnings from schooling.

Singapore is also a rapidly developing LDC. Schooling is found to be significantly responsible for the earnings inequality in the overtaking set in this study. The result is consistent with Liu and Wong's findings. (Liu and Wong 1978:8-9) The results of the present study indicate that, if variations in the rate of return to schooling are ignored, the greater the variance in years of schooling is, the larger the variance of log earnings would be. This pattern is also observed in Liu and Wong's study. (Liu and Wong 1978:6-7)

To sum up, the results of this study show that the schooling component accounts for about 42 per cent of the observed earnings inequality in the overtaking set. Thus, the hypothesis of a significant contribution of schooling to the earnings distribution in the overtaking set is substantiated. The results also substantiate the human capital hypothesis of a positive and significant effect of schooling on individual earnings in the overtaking set.

Observations on Age Groups

Figures given in Table IV-10 actually refer to experience groups only. Since, in general, less experienced workers tend to belong to younger groups, those inferences valid for the less experienced workers may also apply to the younger groups. However, as observed by Chiswick and Mincer, there is more concern with the distribution of earnings by age groups than by experience groups. This is one of the reasons why Chiswick and Mincer expressed

earnings as a function of schooling and age in a study of the personal income inequality for the U.S. (Chiswick and Mincer 1972:S38) Thus, it would be desirable to present figures about the distribution of earnings by age groups. These figures are given in Table IV-11.

As mentioned in Chapter III, primary schooling started to expand rapidly in the early sixties in Hong Kong. Accordingly, those who were 30 years old[1] or younger in 1986 are likely to be under the influence of the expansion of the primary schooling. On the other hand, people aged above 30 in 1986 are unlikely to be under this influence. Thus, we can expect that the average levels of education attainments would be higher while the inequality of schooling would be lower in the younger groups aged below 31 as compared with the older groups. This pattern is clearly shown by the figures given in Table IV-11. Similarly, since the lower secondary education started to expand rapidly in the early seventies, we can expect that the average levels of education attainments would be even higher while the inequality of schooling would be even lower in the groups aged below 26 years old as compared with the groups aged above 25 years old. This pattern is also clearly borne out by the figures given in Table IV-11.

[1] The average age of entry to primary school was about 6-7 years old.

TABLE IV-11
AVERAGE YEARS OF SCHOOLING, VARIANCES OF SCHOOLING AND VARIANCES OF LOG EARNINGS, BY AGE GROUPS, MALE EMPLOYEE/SELF-EMPLOYED PROFESSIONAL LABOUR FORCE AGED 15-60, HONG KONG, 1986[a]

Age Groups[b]	Var(lnY)	Var(S)	$\bar{S}$	N
15-20	0.179	4.507	9.140	14525
21-25	0.182	7.607	9.737	34418
26-30	0.281	11.337	9.519	36274
31-35	0.386	12.897	9.037	28815
36-40	0.463	14.311	8.732	21636
41-45	0.448	17.604	8.247	13943
46-50	0.459	20.608	7.657	14320
51-55	0.411	18.817	6.204	13413
56-60	0.371	16.874	5.371	9308
Aggregate Set	0.382	14.156	8.681	186652

Source : 1986 Hong Kong By-Census, 1/7 of the population.

Notes : a. Variables are as defined in previous tables. All figures reported are up to three decimal places.

b. In this table, groups aged 15-30 are viewed as the younger groups and groups aged 31-60 are viewed as the older groups.

In short, the figures given in Table IV-11 for various age groups indicate that rapid education expansion in Hong Kong not only brings about an increase in the average level of schooling but also equalizes the education attainments within the younger groups. It is expected that the smaller the inequality of schooling is, the smaller the inequality of earnings will be, according to the human capital interpretations. As there are smaller variances in schooling in the younger groups due to the rapid education expansion, smaller variances in earnings are expected in these groups. On the other hand, since there is greater inequality of schooling in the older groups, greater inequality in earnings is expected in these groups. Figures given in Table IV-11 indicate this pattern.

For workers aged 21 to 25, as is shown in Table IV-11, the average level of education attainments is about 9.7 years of schooling. This level is comparatively high as compared with the cohort aged 56 to 60 in which the workers have an average of less than 6 years of schooling. Thus, the difference in education attainments of the younger cohort and the older cohort is substantial. Again, as observed in the previous section, this reflects the problem that though education expansion reduces the inequality of schooling and raises the average level of schooling within the younger cohorts, the older workers are precluded from enjoying the benefits of education expansion. Thus, significant inequality in schooling with direct effects on future earnings occurs between the younger and older cohorts.

To sum up, the findings indicate that rapid education expansion in Hong Kong not only brings about an increase in the average level of schooling but also equalizes the education attainments within the younger groups. Smaller inequality of earnings in the younger cohorts as compared with the older cohorts is observed. The findings also indicate that there is a significant inequality of schooling between the younger and older cohorts.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary and Conclusions

Education is often regarded as a force shaping income size distribution. It is considered a variable which can be controlled by the public policy to achieve the redistribution goal without violating the major tenets of our social, economic and political systems. Investment in schooling is also considered a long-term method which may promote both efficiency, growth and income inequality, without sacrificing one for the other.

For the analysis of the role of schooling in income size distribution, preliminary knowledge of the effect of schooling on income size distribution is crucial. However, empirical studies assessing the effect of schooling on income size distribution are not plentiful and the empirical findings are inconsistent: some studies report a significant effect of schooling on income size distribution but others do not. Therefore, the effect of schooling on income size distribution, i.e. the contribution of schooling toward earnings inequality, deserves further empirical assessment.

Hong Kong is a suitable place for the assessment as it is a rapidly developing LDC with characteristics which may allow the schooling effect to be reflected in the income size distribution. The present study therefore seeks to provide an empirical examination of the effect of schooling on the distribution of

earnings in Hong Kong.

In the study, the effects of schooling on the distribution of earnings are examined by a cross-sectional analysis within a human capital framework. The empirical models used are the earnings inequality function [equation (III-3)] and the variance form of the schooling model [equation (III-6)] derived from a human capital approach to income size distribution. The earnings inequality function is applied to the aggregate set to examine the schooling effect on the aggregate distribution of earnings. The variance form of the schooling model is applied to the overtaking set to examine the schooling effect on the distribution of earnings in the overtaking set. The source of data is the 1986 By-Census of Hong Kong which covers 1/7 of the total population with about 750,000 records. The aggregate set refers to the male working force aged 15 to 60 in Hong Kong restricted to employees and self-employed professional workers. The total number of observations is 186,652. (In order to know whether the results would be different if illiterates are excluded from the aggregate set, a subset obtained from the aggregate set excluding illiterates is also used in the study. The total number of observations of this subset is 179,118.) The overtaking set is further restricted to the workers with 8 to 10 years of experience only. The total number of observations of the overtaking set is 19,771.

The results substantiate the hypothesis of a significant effect of schooling on the distribution of earnings in the aggregate set. The schooling component accounts for 26 per cent

of the aggregate earnings inequality in Hong Kong. If we restrict the population under study to literates only, the direct estimates indicate that the explanatory power of schooling accounting for the aggregate distribution of earnings is almost the same (24 per cent). These findings remain an underestimation because schooling quality is not held constant.

The results obtained from the aggregate set also indicate that most individuals with more schooling tend to belong to a younger cohort. This reflects that there is an upward secular trend in schooling in Hong Kong. This is a natural consequence of the rapid education expansion initiated by the Hong Kong government over the past decades.

According to human capital interpretations, the schooling effect on the dispersions of earnings is least masked by the post-school investments in the overtaking set. Thus, the empirical model [equation (III-6)] is fitted to individuals in the overtaking set to establish the true effect of schooling on the dispersion of earnings[1].

The results also substantiate the hypothesis of a significant effect of schooling on the distribution of earnings in the overtaking set. In this study, the overtaking set is defined as the experience group with 8 to 10 years of working experience. The schooling component accounts for about 42 per cent of the dispersion of log earnings in the overtaking set. Again, this

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[1] See Liu and Wong (1978 pp. 6); Kwok (1984 pp.10); Addison and Siebert (1979 pp. 142).

remains an underestimation because schooling quality is not held constant.

The preliminary hypothesis of a positive and significant effect of schooling on individual earnings in both aggregate and overtaking sets is also substantiated.

Figures about the distribution of earnings have been presented by experience groups (See Table IV-10) and age groups (See Table IV-11). Both figures indicate that rapid education expansion initiated by the Hong Kong government has successfully reduced the inequalities of schooling and raised the average levels of education attainments in the younger or less experienced groups. Smaller inequalities of earnings are also observed in these groups as compared with the older cohorts. On the other hand, the older workers seem to be precluded from enjoying the benefits of education expansion. As compared with the younger cohorts, there are greater inequalities of schooling but lower average levels of education attainments in the older cohorts. Greater inequalities of earnings, in general, are also observed in the older cohorts as compared with the younger cohorts. It is also observed that the difference in the levels of education attainments between the young workers and the older workers is quite large. This reflects the problem that though education expansion may equalize the schooling inequality within the younger groups, there is a substantial inequality in schooling between the younger groups and the older cohorts.

Significance and Comparison

Most of the results of the present research are consistent with the findings of several previous studies.

First, the results of the present study show that the coefficients of schooling, age (a proxy for work experience) and employment are positive and significant. The results substantiate the human capital hypothesis of a positive and significant effect of schooling, age and employment on individual earnings. These results are consistent with the findings of the studies for the U.S. (Mincer 1974; Chiswick and Mincer 1972), Brazil (Velloso 1975) and Hong Kong (Kwok 1984).

Second, this study finds that the schooling component is significantly responsible for the observed relative variance of earnings and the contribution of the employment component to the inequality is quite small relative to that of schooling and age. These results are consistent with the findings of a similar study by Velloso (1975) for Brazil, a developing country in South America.

Third, schooling is found to be significantly responsible for the earnings inequality in the overtaking set in this study. This result is consistent with the findings of the studies for Singapore

(Liu and Wong 1978) and Hong Kong (Kwok 1984)[1]. Furthermore, the schooling model equation is run for different experience groups in the present study. The coefficient of determination is thus obtained for each experience group. The results show that the coefficient of determination rises to a peak in the overtaking period and declines in the subsequent stages of experience. (See Table IV-7 and Table IV-8) As noted by Liu and Wong, this pattern is consistent with the prediction of the human capital schooling model. (Liu and Wong 1978:6) A similar pattern can be observed in a study for Hong Kong by Kwok (1984). Results of the Liu and Wong study for Singapore (1978) also indicate this pattern.

Finally, results of the present study indicate that equalizing the distribution of schooling may help to equalize the distribution of earnings within age groups. This is consistent with the findings of the research in the United Kingdom. (Blaug et al. 1982)

Therefore, the results of the present study may lend further support to the previous findings which generate optimism about the schooling effects on the distribution of earnings.

Policy Implications

The results of the present study show that schooling is

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[1] R^2 for the overtaking set in 1976 obtained in Kwok's study (1984) is 0.47. This implies that the schooling component may account for 47 per cent of the earnings inequality in the overtaking set since R^2 for the overtaking set is equal to:

$$\frac{F^2 Var(S)}{Var(\ln Y)}$$

Note that Kwok defined the overtaking set as the group of workers with 4 to 6 years of work experience in his study. This is different from the findings in the present study. For details, see footnote 1 in pp.101.

positively and significantly related to individual earnings in Hong Kong. Inequality of schooling also accounts for a substantial part of the earnings inequality. Furthermore, the results indicate that there are smaller inequalities in both earnings and schooling in the younger cohorts who are under the influence of education expansion. All these suggest that schooling may have a significant effect on the distribution of earnings in Hong Kong. Therefore, within a human capital context, two policy options may emerge for a reduction in the inequality of earnings in Hong Kong.

One is the universalization of schooling. As mentioned in Chapter III, lower levels of schooling are expanded more rapidly than the upper levels of schooling in Hong Kong. This is a result of the universalization of schooling up to the lower secondary level implemented by the government over the past decades. According to Velloso, such a pattern of education expansion would lead to a reduction in inequality of schooling and, thus, other things being constant, would reduce the earnings inequality. (Velloso 1975:191) As expected, the present study finds that there are smaller inequalities in both schooling and earnings in the younger cohorts who are under the influence of universalization of schooling. These results indicate that universalization of schooling may have an effect on reducing earnings inequality in Hong Kong. Therefore, the researcher would recommend that the government should continue to provide universal lower secondary education and extend universalization of schooling to the senior secondary level (From Five level).

It should be noted that the older cohorts were precluded from enjoying the benefits of universalization of schooling. As a result, it can be said that inequality of schooling not only occurs within the older cohorts but also between the older and younger cohorts, as is shown in Chapter IV. Therefore, besides the policy of universalization of schooling, another policy option is also necessary and desirable. This policy option is the provision of a second opportunity of schooling.

The provision of a second opportunity of schooling may alleviate the inequality of schooling and probably the inequality of earnings within the older groups. It may also alleviate the inequality of schooling and, therefore, other things being constant, may reduce the earnings inequality between the younger and older cohorts. Thus, as a visiting panel observes, "there is a great need for 'second chance' offers" in Hong Kong[1]. In Hong Kong, schooling opportunities are most often not retrievable. Once an individual fails to continue with his schooling while at a young age, he seldom has the opportunity to return to school at an older age since the conventional education system in Hong Kong provides few schooling opportunities for school leavers. Education expansion in Hong Kong over the past decades involves an increase in schooling opportunities for children and youth only. This explains why the older generations in Hong Kong are precluded from enjoying the benefits of education expansion. Since an increase in the average level of schooling of the population is generally regarded as a socially profitable investment (Marin and

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[1] See A Perspective on Education in Hong Kong : Report By a Visiting Panel (Llewellyn 1982 pp. 77).

Psacharopoulos 1976:337), provision of a second opportunity of schooling for the people with low education attainments is a policy worthy of support.

The provision of a second chance of schooling may have another advantage. It may increase the total supply of labour with higher levels of schooling and, thus, other things being constant, lower the rates of return to upper levels of schooling. This may narrow the gap between the rates of return to upper and lower levels of schooling. A decrease in the differences between the rates of return to upper and lower levels of schooling is regarded as a policy option to reduce earnings inequality within a human capital context. (Velloso 1975:191) Evidence from other studies shows that there are differences between the rates of return to upper and lower levels of schooling in Hong Kong. For example, by discounting age profiles of earnings and estimating the direct costs of schooling, Hung (1982) found a rate of return of 18.5% for senior secondary education and 25.2 % for university education in Hong Kong. A second chance of schooling may decrease the differences between the rates of return to upper and lower levels of schooling and, thus, may reduce the earnings inequality in Hong Kong.

However, as Luk observes, a careful manpower planning is needed to ensure that the provision of a second opportunity of schooling meets the demand of the labour market[1]. Otherwise, there

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[1] 參看陸鴻基 (197?) 〈「第二次機會」的專上教育〉頁64. (手稿)

will be a problem of unemployment or underemployment of the overeducated labour. When we extend universalization of schooling to upper education levels, we may also need to consider manpower needs of the labour market.

It should be noted that the role of schooling in determining earnings distribution may change subject to the influence of the government. This implication is conceivable as the Hong Kong government is the biggest single employer that employs about 11 per cent of the total labour force in the present study. Thus, being the biggest single employer, the government may play an important role in determining the reward to different levels of schooling in the labour market. Actually, many employers in the private sector follow the pay scale of the government. Besides, most of the education institutions in Hong Kong are, directly or indirectly, financially supported or subsidized by the government. Thus, the potential of the government in determining the distribution of earnings in Hong Kong should not be neglected.

When Carnoy examined the empirical studies of education and earnings distribution in Brazil, Chile, Cuba, Mexico, and Peru (all of them are developing countries), he suggested that an "education policy can only contribute to the more equal distribution of earnings when it is carried out in concert with an incomes policy[1] which attempts to equalize the earnings of workers with lower levels of schooling, in lower paying occupations, economic activities, and regions, and with less experience in the labour

[1] This refers to a government incomes policy.

force to those in the higher paying categories of each of those variables." (Carnoy 1979:98) This observation may also apply to Hong Kong.

Limitations

The results also indicate that a substantial fraction of the earnings inequality is unexplained by the human capital functions used in the present study. The unexplained fraction of the earnings inequality is largely dictated by the data limitations.

Empirically, the distribution of schooling investments is only partly measured by the distribution of years of schooling in the present study. Variations in the quality of schooling are left in the residual because they are difficult to measure[1]. This contributes to a larger residual variance. Since the schooling investments measured by years of schooling are not adjusted for the quality of schooling, the explanatory power of schooling investments in the distribution of earnings is underestimated. (Mincer 1974:52-57, 96, 134; Liu and Wong 1978:8)

The significant residual variance may reflect that there are several factors responsible for the distribution of earnings unexplained by the human capital functions[2]. Among these determinants, socio-economic origins of the individual are always

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1 Years of schooling are commonly used as the empirical approximation of schooling investments in many studies using the human capital framework.

2 Without claiming to be exhaustive, these unexplained determinants of income size distribution are listed in Appendix I.

mentioned in the analyses and literature of the income size distribution.

Evidence from other studies indicates that socio-economic origins may have a positive effect on access to schooling and probably on schooling attainment. (Velloso 1975:218-219) Socio-economic origins may also have a direct effect on earnings. Family connections, for instance, may help the individual to obtain a better paid job and/or provide him with a better information network when searching for a job. Furthermore, socio-economic origins seem to have an effect on pre-training investments. Pre-training investments may also have an effect on earnings which can be conceptually viewed as independent of the level of schooling attained, though they are difficult to measure. (Velloso 1975:220-221) As noted by Levin, pre-training investments in human capital such as health care, nutrition, shelter and other sorts of family influences may ultimately result in higher productivity and earnings. (Levin 1972:5-13) Parents with low education levels, as Levin observes, have relatively larger limitations on the amount of knowledge that they can pass onto their children. These parents may also have limitations in the area of verbal skills and psycho-social behaviour required to participate in existing social institutions. As a result, children from these families will tend to have lower skill levels and their overall opportunities of economic success will also tend to be smaller than those of their counterparts from more well-to-do families.

Since socio-economic background is excluded from the human

capital earnings function due to data limitations and since this variable is positively associated with schooling investments, the coefficient of schooling is biased upwards[1]. However, as indicated in Chapter III, the empirical approximation of experience by age yields a relatively smaller value for the estimated average rate of return to schooling. This tends to offset the overestimation of the coefficient of schooling due to the exclusion of the socio-economic origins from the human capital earnings function. Thus, it is possible that the specification used yields an adequate value for the average rate of return to schooling, but a priori the net effect is unclear. (Velloso 1975:219) In addition, as noted before, the explanatory power of schooling in the distribution of earnings is underestimated since the quality of schooling is not held constant. Again, this tends to offset the overestimation of the coefficient of schooling due to the exclusion of the socio-economic origins from the human capital earnings function, though the net effect is unclear.

Furthermore, a fuller analysis may be obtained if time-series data are used[2]. The present study is a cross-sectional analysis using census data from Hong Kong in 1986 only.

Schooling as a determinant of income size distribution also has its limitation. By its very nature, schooling is mainly a factor of the supply side on the labour market. It cannot play

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[1] In a regression equation, if the coefficient of a variable X is positive and if this variable is positively correlated with a left-out variable Y, then the estimated coefficient of Y will be biased upwards. (Kmenta 1971:391-5)

[2] Time-series analysis is possible in the Chiswick and Mincer study (1972) because they have sufficient data for each year ranging from 1949 to 1969.

its role independent of the demand factors of the labour market. This probably explains why schooling has a relevance to income size distribution in Hong Kong : it is because there is a demand for educated labour in Hong Kong, a rapidly developing LDC. In addition, the role of schooling in income size distribution seems to be under the influence of the government in Hong Kong. Thus, more research should be carried out in the direction of understanding the relationship among schooling, socio-economic origins, government income policies and the demand factors of the labour market in the distribution of personal income in Hong Kong.

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APPENDIX I
DETERMINANTS OF INCOME SIZE DISTRIBUTION

TABLE A. I-1
DETERMINANTS OF INCOME SIZE DISTRIBUTION[a]

Determinants
Ability
Inherited endowments
Age
Differences among jobs (different behaviourial requirements of the jobs, different traits, different life-styles compatible with the jobs, and different job nature)
Social class
Government Incomes Policy
Taxation and consumption transfers (direct income transfers)
Schooling
Chance, luck and random occurrences

Note : a. References : Piore (1970 pp. 53-83); Mincer (1970 pp. 1-26); Bowles and Gintis (1975 pp.74-82); Cain (1976 pp. 1215-57); Sahota (1978 pp.1-55); Carnoy (1979 pp. 96-98) and Cohn (1979 pp. 31-32).

APPENDIX II
ESTIMATION OF THE YEARS OF SCHOOLING

TABLE A. II-1
ESTIMATION OF THE YEARS OF SCHOOLING

Level of Educational Attainment	Years of Schooling
No schooling or kindergarten	0
Lower Primary (P1 to P4)	3
Upper Primary (P5 to P6)	6
Form 1/Middle 1	7
Form 2/Middle 2	8
Form 3/Middle 3	9
Form 4/Middle 4	10
Form 5/Middle 5	11
Matriculation	12
Craft Courses	11
Technical Institute Courses	13
Higher Diploma Courses	14
Non-degree Courses	
Teacher Training Courses	
Nurse Training Courses	
Associateship	16
First Degree Courses	
Overseas First Degree Courses	
Postgraduate Courses	18

APPENDIX III

MEANS, STANDARD DEVIATIONS, CORRELATIONS AND ADDITIONAL REGRESSION ESTIMATES

TABLE A. III-1

MEANS[a], STANDARD DEVIATIONS[b] AND CORRELATIONS[c] OF SCHOOLING, AGE AND LOG OF TIME WORKED, MALE EMPLOYEE/SELF-EMPLOYED PROFESSIONAL LABOUR FORCE AGED 15-60, HONG KONG, 1986[d]

	Aggregate set	Subset (Excluding Illiterates)
$\bar{S}$	8.68	9.05
SD(S)	3.76	3.38
$\bar{A}$	34.18	33.66
SD(A)	11.24	10.97
$\bar{W}$	5.29	5.30
SD(W)	0.71	0.70
R_{sa}	-0.30	-0.22
R_{sw}	-0.02	-0.04
R_{aw}	>-0.01	<0.01
N[e]	186,652	179,118

Source : 1986 Hong Kong By-Census, 1/7 of the population.

Notes : a. $\bar{S}$, $\bar{A}$ and $\bar{W}$ stand for averages of schooling, age and log of time worked, respectively. Averages of schooling years, age and log of time worked, although not used in the decomposition analysis, are supplied as additional information.

b. SD(S), SD(A) and SD(W) stand for standard deviations of schooling, age and log of time worked, respectively.

c. R_{sa} = zero-order correlation coefficient of schooling and age; R_{sw} = zero-order correlation coefficient of schooling and log of time worked; R_{aw} = zero-order correlation coefficient of age and log of time worked. All coefficients are significant at the 0.0001 level.

d. All figures reported are up to two decimal places.

e. N = total number of observations.

TABLE A. III-2
CORRELATIONS OF LOG EARNINGS AND SCHOOLING[a] WITHIN EXPERIENCE GROUPS, MALE EMPLOYEE/ SELF EMPLOYED PROFESSIONAL LABOUR FORCE AGED 15-60, HONG KONG, 1986[b]

Years of Experience	R_a^2	R_b^2
below 4	0.380	0.364
4-7	0.429	0.405
8-11	0.455	0.418
12-15	0.446	0.411
16-19	0.356	0.334
20-23	0.254	0.245
24-27	0.203	0.192
28-31	0.193	0.179
32-35	0.196	0.172
36-39	0.144	0.124
40-43	0.049	0.047
44-47	0.012	0.022
over 47	0.003	0.025

Source : 1986 Hong Kong By-Census, 1/7 of the population.

Notes : a. R_a^2 = coefficient of determination of regression equation: $\ln Y = \alpha + b_1 S + b_2 S^2$;

R_b^2 = coefficient of determination of regression equation: $\ln Y = \alpha + rS + \ln W$

where b_1 = coefficient for schooling;

b_2 = coefficient for schooling squared;

W = total hours worked;

other variables are as defined in Table IV-7.

b. All figures are reported up to three decimal places. The total number of observations is 186,652.